How spatial planning measures and tools are used to reduce the risks of a flood

An exploration of the institutional barriers for spatial planning in flood risk management

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Abstract

The cornerstone of the flood risk management policy is the prevention of floods and the safety standards are embedded in the primary flood defence system. New insights in climate change and socio-economic developments have given urge to a broader focus on prevention, mitigation, preparedness and vulnerability reduction of floods. The multi-layer safety concept is conceptualizing this broader focus by preventing floods with the addition the use of spatial planning and crisis management to reduce the impacts of a flood. The multi-layer safety approach does link the domains of spatial planning and water management to have a broader instrumentation on reducing the risks of a flood and acknowledges a deliberate interdependency between the domains. The role of spatial planning is emergent within the flood risk management policy and this research has shown that spatial planning measures could fulfil a versatile role in reducing the risks of a flood.

Keywords: institutional barriers, path dependency, spatial planning, flood risk management, multi-layer safety concept.

Summary

In past decades, Dutch flood protection has been based on technical measures such as dikes, dams and storm-surge barriers, designed and maintained to ensure high safety standards (Schultz van Haegen and Wieriks, 2015). These technical measures for the protection against water, however, are no longer adequate solutions for climate change (Woltjer and Al, 2007). An integrated approach on water safety could feature a new role for spatial planning; linking the domain of water management with the domain of spatial planning in order to work on flood prevention and consequence reduction.

The purpose of this study is to explore the usage of spatial planning as risk reductive measure in flood risk management and the link between water management and spatial planning in the flood risk management approach. The importance of a link between space (spatial planning) and water (water management) is emergent were *"disaster risk reduction, water resources' management and climate adaptation should no longer be treated as separate topics"* (Schultz van Haegen and Wieriks, 2015) and as the risk based approach is considered from the consequences of a flood as well (Zandvoort and van der Vlist, 2014). The domain of flood risk management has shifted away from the single objective of flood defence (Klijn et al., 2008, page 308), towards the connection of different policy fields and the use of multiple tools or tool mixtures to address the multiple goal orientation on flood risk management. A broader focus on prevention, mitigation, preparedness and vulnerability reduction is needed (Schultz van Haegen and Wieriks, 2015). The changed institution on flood risk management asks for a different approach by the organizations working within the domain of flood risk management.

The aim of this research is to explore the institutional barriers for spatial planning in flood risk management. The analysis from a multi-level actor perspective could help to explain the complexity of flood risk management and the link between the domain of spatial planning and the domain of water management from different viewpoints and try to reveal the obstacles which have to be overcome. The research focusses on the extent of spatial planning tools and measures in managing flood risks and tries to gain insight in the use of adequate spatial planning measures in reducing the risk of a flood.

The following main research question has been formulated for this study:

> **Which institutional path dependence processes could be determined from the use of spatial planning measures and tools in the flood risk management approach?**

To answer this main research question, the following sub-research questions are guiding:

1. What use is made of spatial planning in flood risk management?
2. What is (institutional) path dependency and which paths could be drawn from the use of spatial planning in flood risk management?
3. Which barriers arise from institutional path dependency in the use of spatial planning in flood risk management?

The research is based on a case study design. The cases investigated are:

1. the Maasvallei in the province of Limburg, where the river Meuse shaped the riverbed through the hilly region into a wide valley. The Maasvallei is only partially protected by dikes and there is no continuous dike system. The specific case of the Willem Alexanderhaven in the city of Roermond, is studied, because the multi-layer safety concept has been part on the conceptualisation of plans in this area.

2. The IJsseldelta-Zuid which is part of the low lying area of the IJsseldelta. This area susceptible for the climatological impact on high river discharges, and influenced by high water levels in the IJsselmeer Lake. The IJsseldelta-Zuid, part of the Room for the River Programme, is the area where the water safety aspect for the region is enlarged by deepening the riverbed of the IJssel and the construction of a bypass from the river IJssel towards the IJsselmeer lake.

3. The IJssel-Vechtdelta is considered as a high value area, but also vulnerable. Values of the IJssel-Vechtdelta lie within the social-economic aspects; growth region, cultural historic values, and environmental values. The tasks for the development of this area are investigated on the link between spatial planning and water safety; working towards a sustainable spatial outlook of the IJssel-Vechtdelta (Provincie Overijssel and IJssel-Vechtdelta, 2012). This is conceptualised with the multi-layer approach of water safety, linking the regional aspirations and targets, climate proof growth and spatial quality.

This research is conducted via a theoretical lens based on three concepts: path dependency, institutional chance and policy design. This research focused on the change taking place in the policy of flood risk management and the role of spatial planning in it. The theory of path dependency is used as a way to explain how certain choices within the process of flood risk management are made and which mechanisms play a role in it. The mechanisms of the institutional change are used to see which barriers in flood risk management have to be overcome and how this could result in new insights on spatial planning in the flood risk management policy or the design of the flood risk management policy as a whole. Policy design is used to investigate the link between goals, objectives and targets.

The frame of institutional change is used to see how policy concepts changed the way of governance practices. *"New concepts have to challenge and shift an array of already routinized governance processes, with their complex mixture of conscious and taken-for-granted modes of practice. New concepts have to 'jump' boundaries and 'break through' resistances, involving implicit and explicit struggles"* (Healey, 2006, page 305). The multi-layer safety approach has shifted the routinized governance process of flood prevention with the inclusion of the probability factor. The new concept of the multi-layer safety approach has to jump and break through boundaries, because it is not only building on technical measures in the prevention of floods. The taken-for-granted mode with technical measures is not suited under the changing conditions of climate and social-economic development.

Path dependency has helped to understand how paths on water safety have changed in time, in order to create flood safe environments. Path-dependency is defined as: *"one whose outcomes evolves as a consequence of the process's or system's own history* (Martin and Sunley, 2006, page 399). This conceptualisation of path dependency corroborates the theory institutional change, in which path dependency can be investigated to study how the institutionalization of a new concept results, or not, in new paths. New insights in flood risks, and how these flood risks are influenced by changing conditions like socio-demographic changes and climatological changes have resulted in political action on flood risk management. New paths could be created in situations when actors within the process are able to access, understand, and convert knowledge, into new path or renew older ones (Martin and Simmie, 2008).

The theory of policy design is studied from the basis of policy formulation where two dimensions are taken into account; (1)policy formulation and (2)policy tools and instruments (Howlett et al., 2015). Policy instruments are the *'tools of government'*, the mechanisms and techniques used to implement or shape policies and institutions (Salamon, 2002, Howlett and Rayner, 2007). Policy instrument choice consists of abstract general aims or goals, along with a set of les abstract objectives which are projected to achieve the aims or goals. The objectives must be incorporated in a set of specific targets or measures which allow policy resources to be directed toward goal achievement (Howlett, 2009). This altogether can affect the current path and can be deliberately effectuated by policy entrepreneurs to direct institutional change onto their desired path.

This research has shown a large complexity concerning the use of spatial planning in flood risk management. The role of spatial planning is versatile and does vary a lot from the different cases investigated. Spatial planning could fulfil a role on improving the spatial quality of the area. In such cases it does not contribute to

water safety, but does improve spatial quality besides water safety measures from the domain of water management. The other use of spatial planning in flood risk management refers back to the role it could fulfil from the multi-layer safety concept. In this concept spatial planning fulfils the role on reducing the consequences of a flood. This could be a combination of preventive measures from the domain of water management and consequence reduction with measures from the spatial planning domain. This is also described as smart combinations. Combining prevention and consequence reduction. But the element of consequence reduction could also be a stand-alone measure in, for instance, outer dike areas. Here there are no other defence mechanisms and spatial planning could work as a consequence reductive measure; it is not possible to prevent a flood in these areas. Spatial planning could also contribute in the prevention of floods. This research has shown that also the prevention of floods could be approached with spatial planning measures. The floodplain park in the harbour of Roermond and a regional defence system by filling gaps between natural heights to create flood defence line in the landscape near the city of Zwolle proof that the role of spatial planning is more diverse.

Path dependency has provided insight in the interrelationship between flood risk management and spatial planning in the context of developing the flood risk management policy and the realization of adaptive plans (Hetz and Bruns, 2014) to control floods. The multi-layer safety approach is in the preformation phase from a path dependency perspective and the policy has to be shaped and implemented. Testing grounds have been set up with clear objectives on providing knowledge and experiences in the national policy on flood risk management in order to develop a vision on the water safety policy in order to improve the water safety aspect (Oranjewoud and HKV Lijn in Water, 2011). The existing structures have shifted to a wider focus on the on the prevention of flood, the cornerstone of flood risk management, with the addition of spatial planning and crisis management (Schultz van Haegen and Wieriks, 2015)

This research has shown that a development path could arise from the spatial planning perspective as well as the water management perspective. Linking the paths from these two domains could be difficult, because a link between the spatial planning and water management is weak or indirect (Woltjer and Al, 2007). The 'old' paths in flood risk management still exist, where the domains of spatial planning and water management are treated as different modes of governance (Hartmann and Driessen, 2013). New policy strategies have strengthened linkages between water management and spatial planning (Woltjer and Al, 2007). The importance of a link between space (spatial planning) and water (management) is emergent were and as the risk based approach is considered from the consequences of a flood as well (Zandvoort and van der Vlist, 2014). A broader focus on prevention, mitigation, preparedness and vulnerability reduction is needed (Schultz van Haegen and Wieriks, 2015). Linkage of the domains of water management and spatial planning could acknowledge a deliberate interdependency between the two domains and could result in a better foundation for smart combinations of the measures from these domains.

Institutionalization is building on knowledge and these knowledge gaps are the barriers in institutionalization of the multi-layer safety concept affecting the adaptation of this concept. The *"…financial, technological, cognitive, behavioural, political, social, institutional and cultural constraints limit both the implementation and effectiveness of adaptation measures"* (Dovers and Hezri, 2010). This research has shown that some of these assets are a constraint and limit the implementation and is of effect on the effectiveness of the multi-layer safety concept. Actors within the process are not able to access, understand, and convert knowledge, into new path or renew older ones (Martin and Simmie, 2008).

The cornerstone of the flood risk management policy is the prevention of floods and the safety standards are embedded in the primary flood defence system. New insights in climate change and socio-economic developments have given urge to a broader focus on prevention, mitigation, preparedness and vulnerability reduction of floods. The multi-layer safety concept is conceptualizing this broader focus by preventing flood with hard-core flood defence systems and in addition the use of spatial planning and crisis management to reduce the impacts of a flood. This research has shown that paths could be developed with the use of spatial planning on the prevention of flood and reducing the consequences. But the development of these paths do include elements of uncertainty. Because the safety norms are embedded in the primary flood defence systems, layer one of the multi-layer safety approach, the incentive to invest in spatial planning measures is missing. Investments in spatial planning measures are water safety measures considered as extra, because the safety norm has to be met with measures from the first layer of the multi-layer safety approach.

The multi-layer safety approach does link different domains to have a broader instrumentation on reducing the risks of a flood. Linking the domains of water management and spatial planning acknowledges a deliberate interdependency between the domains and could be a foundation for smart combinations with measures from

these domains to a comprehensive and deliberate consideration on measures from both domains in flood risk management. Smart combinations and could be an alternative for dike reinforcement or link a dike reinforcement with optimal use of (spatial) opportunities (meekoppelkansen) (Ellen and Buuren, 2014). But the path of preventing a dike reinforcement with the use of spatial planning measures is making use of short term spatial investments which have a long term return, with the possible prevention of a dike rise. The institutional constraint on interchangeability however, is limiting the implementation of spatial planning measures in the flood risk management policy. Spatial planning measures could not interchange primary flood defence measures now and thus the development of this institutional asset is a constraint in the acceptation of the multi-layer safety approach.

This research has tried to explore the institutional barriers on the use of spatial planning in flood risk management. Because institutional barriers exist the development of paths in the multi-layer safety concept is influenced by missing the knowledge in the long term development of this concept. The concept is changing its institutions. The barriers form this research could help in the reflection on the use of spatial planning in flood risk management. The role of spatial planning is emergent within the flood risk management policy and this research has shown that spatial planning measures could fulfil a versatile role in reducing the risks of a flood.

“Do research. Feed your talent. Research not only wins the war on cliché, it's the key to victory over fear and its cousin, depression.” - Robert McKee

This master thesis is the final part of my Master Spatial Planning at Wageningen University. The cherry on the cake. I want to thank Maarten and Mark for their support and knowledge. A special thanks to my parents, Adrie and Wilma, for their confidence and belief in me.

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1 Introduction

1.1 A short view on the history of floods in the Netherlands

The Netherlands have a long history with water and floods. The Dutch fought against water for many centuries, which shaped the surface area of the Netherlands, where today almost 26% of the Netherlands lies below sea level (Slomp, 2012). Water management is part of the Dutch national and cultural heritage, but new insights in the water system and changing physical and societal circumstances force policy on water management to adjust (Wiering and Immink, 2006).

In past decades Dutch flood protection was based on technical measures such as dikes, dams and storm-surge barriers, designed and maintained to ensure high safety standards (Schultz van Haegen and Wieriks, 2015). These technical measures for the protection against water, however, are no longer adequate solutions for the problems caused by climate change (Woltjer and Al, 2007). On the long term, river discharges will become higher and more extreme (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). The continuation of economic growth, population growth and spatial development, increase the economic and social values protected against flood. These socio-economic changes are of influence on the consequences of a flood; the possibility of more fatalities and large economic damages (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014b). There is a shift in flood risk management *"away from the single objective of flood defence via the control of the flood hazard (physical defence measure) towards management of flood risks proper through also influencing the vulnerability of society"* (Klijn et al., 2008, page 308). The focus of flood risk management is expanding from *"a traditional focus on mitigation the (direct) impacts of disasters using stand-alone and ad-hoc interventions to a broader focus on prevention, mitigation, preparedness, and vulnerability reduction"* (Schultz van Haegen and Wieriks, 2015, page 54).

The largest problems for water safety are located in the Rhine-Meuse river system. Seen from the risk of flooding, the river system is the most dangerous system (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). Three hundred kilometres of river dikes are not sufficient based on the current safety standards. Besides, new safety standards demand a higher level of protection for almost the complete river area because of the risk on high numbers of fatal losses and large economic damage when a flood occurs. Recent floods in New Orleans and throughout Europe have confronted the Dutch with the fact that floods can still happen and are able to disrupt modern societies and economies more than ever (Ministerie van Verkeer en Waterstaat et al., 2009). Insight in the effects of climate change and socio-economic changes resulted in new views on the protection against floods and are raising urge to adapt strategies on water safety. The policy on water safety in the Netherlands is evolving from the prevention of floods by dikes, towards flood risk management based on a combination of dikes, spatial planning and adequate risk control, combined in what is called the multi-layer safety approach (Ministerie van Verkeer en Waterstaat et al., 2009).

1.2 The risk based approach in flood risk management

The target of flood risk management is to attain a sustainable control of flood risks on a societal acceptable level (Ministerie van Verkeer en Waterstaat et al., 2009). The objective of flood risk management can be defined as *'to minimize flood risk by implementing measures that reduce risk most efficiently'* (Hooijer et al., 2004, page 345). Flood risk is considered as *"the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event"* (Directive 2007/60/EC., 2007, article 2.2). Where flood risk management plans *"should focus on the prevention, protection and preparedness* [and] *include the promotion of sustainable land use practices, improvement of water retention as well as the controlled flooding of certain areas in the case of a flood event"* (Directive 2007/60/EC., 2007, article 7.3).

Flood risks are expressed in an equation which is stating the probability of a flood combined with the consequences of a flood; the risk based approach. Flood risk management is divided along three layers, where the first layer is focussing on the prevention of flood, the second on the protection when a flood occurs, and the third by being prepared on what to do in times of a flood, conceptualised in the multi-layer safety approach.

The policy on water safety is changing towards a risk based approach, which can be defined in the following equation:

Risk = Probability x Consequence

With this equation the risk of a flood is expressed in a probability factor and a consequence factor. The probability factor of a flood is based on flood prevention. The consequence factor is based on keeping the consequences of a flood a low as possible by focussing on the exposure and vulnerability of a flood (Ministerie Infrastructuur en Milieu and Ministerie Economische Zaken, 2014; Klijn et al., 2012).

The new policy on water safety is working towards a basic level of protection of 10^{-5} for each individual. This means that the chance of fatal injure for an individual caused by a flood is not larger than 1 in 100.000 per year (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). Plus, the introduction of a new set of safety standards for flood defences, based on a societal cost benefit analysis (Schultz van Haegen and Wieriks, 2015, page 54).

1.3 The multi-layer safety approach

The multi-layer safety approach is introduced as an approach to keep flood risks controllable in the future (Ministerie van Verkeer en Waterstaat, 2008) and is executed along three lines. 1. smart combinations (as alternative on the reinforcement of dikes), 2. reducing the vulnerability of vital infrastructure and 3. water robust development (Ministerie van Infrastructuur en Milieu, 2014). The risk based approach is conceptualised by anticipating on the socio-demographic and climatological developments, wherein flood risks play an important part together with sustainable spatial planning (Ministerie van Verkeer en Waterstaat et al., 2009).

The multi-layer safety approach exists of three layers. The first layer is based on the prevention of flood, the second layer on sustainable spatial planning and the third layer on disaster management. The latter two are primarily based on keeping the consequences of a flood a low as possible. The three layers will be explained more into detail below.

The first layer of the multi-layer safety approach is focussed on the prevention of floods and has the highest priority. This is a continuation of the successful strategy of the Dutch water safety policy, with a focus on sandy beaches, spacious river beds, combined with strong dikes, dunes, dams and storm surge barriers (Ministerie van Verkeer en Waterstaat et al., 2009). The proposals for new standard specifications are set within this layer for the primary flood defence systems (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a).

Sustainable spatial planning can reduce the number of victims and the damage caused by floods. Flood risks are going to fulfil an important role in considerations on spatial planning, by clever location choice and sustainable planning of vulnerable infrastructures (Ministerie van Verkeer en Waterstaat et al., 2009). *"Consider flood risks and climate-proofing in spatial (re)development, for the purpose of limiting any flood related damage and any additional damage ensuing from spatial development"* (Ministry Infrastructure and Environment and Ministry Economic Affairs, 2014, p.14). Important vulnerable infrastructures in relation to water robustness are energy supply, telecom/ICT, food supply, vital infrastructures and drinking water supply. These functions are crucial in reducing social disruption during floods, and therefore it is necessary that these functions operate as long as possible if a flood occurs.

The third layer is focussed on crisis management in time of a flood; evacuation strategies. Organisational preparation is essential for acting efficiently in time of a flood. This will reduce victims and (economical) damage (Ministerie van Verkeer en Waterstaat et al., 2009).

For an proper fulfilment of the second and third layer, safety norms need to be clear in order to have the right perspective on action for professionals in spatial planning and disaster management (Ministerie van Verkeer en Waterstaat, 2008). With the implication of spatial planning and disaster management within the water safety approach, other actors beside water management are responsible for water safety. The second and third layer are considered to reduce the level of exposure and vulnerability, but these layers also offer possibilities to reduce the probability and prevention factor of a flood (Zandvoort and van der Vlist, 2014).

The multi-layer safety approach does give way to alternatives for strengthening water defence systems (Ministerie van Infrastructuur en Milieu, 2014). Combinations of measures from the three layers of the multi-layer safety approach are called smart combinations. The combination of different layers of the multi-layer safety approach has to constitute an alternative to solution to a flood risk management system only based on a preventive measure as a result of the strengthening of the safety standards (or other strengthening tasks) (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014b).

1.4 Spatial planning in flood risk management

Anticipating climate projections transformed the way of dealing with water from a reactive based policy, where the safety measures are a reaction on a disaster, towards an adaptive based approach to anticipate on what might come (Schultz van Haegen and Wieriks, 2015). This new approach on water challenges the domains of both water management and spatial planning (Hartmann and Driessen, 2013). Because not only the water system is included in this new approach on water management, but also measures for sustainable land use and disaster response. This demands integration of the domain of spatial planning into ensuring water safety in the Netherlands.

The integrated approach on water safety could feature a new role for spatial planning; linking the domain of water management with the domain of spatial planning in order to work on flood prevention and consequence reduction. A complex ambition, because it demands a cooperation of many actors on a local and regional level, in trying to reach a water robust and climate proof discourse for governments, businesses, and civil societal organisations (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). Moreover, for the realisation of this ambition it is necessary to integrate water safety and climate proofing into spatial plans, redevelopments, and investments in management, maintenance and replacement (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a).

Land use changes in relation to the prevention of floods "*offer clear advantages when considered as part of a strategy for integrated development of the river corridor that aims to optimize more than one function and takes into account nature and landscape values"* (Hooijer et al., 2004). It is not only nature and landscape values which could be combined with the development flood risk strategies, but the attempts of a comprehensive risk based approach on floods are still minimal (Klijn et al., 2008), combining a technical view on floods together with a social view on floods, where not only the focus is on the prevention of a flood but the possible damage or consequences of a flood as well, resulting in a combination of water safety and spatial investments.

Historically seen, water safety has played a neglected role in spatial planning. Because of this, housing locations are planned in deep polders (Ministerie van Verkeer en Waterstaat, 2008). To prevent this from happening again, water safety has to fulfil an important role in spatial planning. It is necessary to make deliberate spatial choices and therefore it is necessary to link spatial planning to flood risk management. The responsibility on safe and sustainable spatial planning is primarily within the concern of the Province and the Ministry of Housing, Spatial Planning and Environment and water managers will have an advising and informing role (Ministerie van Verkeer en Waterstaat, 2008). Profitability and feasibility of measures within the second layer are enlarged if they also contribute to other (water) tasks and urgent spatial developments.

Thus, an integrated and comprehensive mode of governance in flood risk management is needed to include not only physical defence measures, but also sustainable land use practices such as adaptive building and special land-use constraints to manage water (Hartmann and Juepner, 2014).

1.5 Problem Statement

Flood risk management has changed by introducing the risk based approach, wherein not only the risk of a flood is taken into account, but the consequences of a flood as well. This new approach on flood risk is challenging the water management domain and spatial planning domain, with a highly complex policy (Zandvoort and van der Vlist, 2014). The role of spatial planning is already enlarged in the programmes like Room for the River, but this role implied working besides water management. The changed policy of flood risk management changed this attitude towards working together with water management, where spatial planning is fulfilling a water safety role as a risk reductive measure.

But as stated before, the contribution spatial planning could be not only on consequence reduction but on the prevention of floods as well. I argue that the spatial planning domain could fulfil a large role in reducing the risks of a flood, both on the prevention of a flood as reducing its consequences. But how does this statement relate to reality? Is it possible for spatial planning to contribute to the whole spectrum of the flood risk policy domain and how does this work out? What problems occur with the use of spatial planning in flood risk management? Which changes should be made to overcome these problems?

1.6 Research objective & questions

The purpose of this study is to explore the usage of spatial planning as risk reductive measure in flood risk management and the link between water management and spatial planning in the flood risk management approach. The importance of a link between space (spatial planning) and water (water management) is emergent were *"disaster risk reduction, water resources' management and climate adaptation should no longer be treated as separate topics"* (Schultz van Haegen and Wieriks, 2015) and as the risk based approach is considered from the consequences of a flood as well (Zandvoort and van der Vlist, 2014). The domain of flood risk management has shifted away from the single objective of flood defence (Klijn et al., 2008, page 308), towards the connection of different policy fields and the use of multiple tools or tool mixtures to address the multiple goal orientation on flood risk management. A broader focus on prevention, mitigation, preparedness and vulnerability reduction is needed (Schultz van Haegen and Wieriks, 2015). The changed institution on flood risk management asks for a different approach by the organizations working within the domain of flood risk management.

The domain of spatial planning can fulfil a broad and versatile role in flood risk management. The actual extent of spatial planning as risk reductive measure is investigated in this research to get insight in the use of spatial planning measures in reducing the risk of a flood, and the barriers which have to be overcome to work towards an institutional path of adequate spatial planning in flood risk management.

The aim of this research is to explore the institutional barriers for spatial planning in flood risk management. The analysis from a multi-level actor perspective could help to explain the complexity of flood risk management and the link between the domain of spatial planning and the domain of water management from different viewpoints and try to reveal the obstacles which have to be overcome. The research focusses on the extent of spatial planning tools and measures in managing flood risks and tries to gain insight in the use of adequate spatial planning measures in reducing the risk of a flood.

The following main research question has been formulated for this study:

> **Which institutional path dependence processes could be determined from the use of spatial planning measures and tools in the flood risk management approach?**

To answer this main research question, the following sub-research questions are guiding:

4. What use is made of spatial planning in flood risk management?
5. What is (institutional) path dependency and which paths could be drawn from the use of spatial planning in flood risk management?
6. Which barriers arise from institutional path dependency in the use of spatial planning in flood risk management?

The research is based on a case study design with in-depth interviews to explore and understand if and how institutions are changing, together with a reflection on path dependency and policy design to draw a conclusion on barriers to overcome in the use of spatial planning in flood risk management. This is done with the theories of institutional change, path dependency and policy design. Insights in these theories will be provided in the next chapter.

2 Theoretical framework

This chapter elaborates on the theory used in this research. This research focusses on the change taking place in the policy of flood risk management and the role of spatial planning in it. As stated in the introduction, the domain of flood risk management has a long history in the Netherlands, but new views on the risks of floods has changed the flood risk management policy. To explore and understand these changes in flood risk management, the theories of path dependency, institutional change and policy design are used. The theory of path dependency is used as a way to explain how certain choices within the process of flood risk management are made and which mechanisms play a role in it. The mechanisms of the institutional change are used to see which barriers in flood risk management have to be overcome and how this could result in new insights on spatial planning in the flood risk management policy or the design of the flood risk management policy as a whole. Policy design is used to investigate the link between goals, objectives and targets. This chapter introduces the key elements of these theories to understand why and how these theories form the theoretical lens for this research.

2.1 Institutional change

The theory of institutional change is used to see how different actors involved in flood risk management are dealing with the changed policy. I first introduce institutional change and continue describing how institutional change can help understanding changes in flood risk management.

2.1.1 What is institutional change?

Before introducing institutional change, I want to explain the difference between institution and organisation, because these terms are used interchangeably, but are not the same. Moroni (2010) states that: *"Institutions are sets of basic rules of conduct, acknowledged by a community, and usually enforced through some form of sanction; while organizations are systematic arrangements of resources for achieving explicit shared goals."* (Moroni, 2010, page 277).

North, 1990, has emphasized the distinction between the institutions and organisation as: *"The purpose for the rules [the institutions] is to define the way the game is played. But the objective of the team [the organization] within that set of rules is to win the game – by a combination of skills, strategy, and coordination. Modelling the strategies and the skills of the team as it develops is a separate process from modelling the creation, evolution, and consequences of the rules.* (North, 1990, cited from Moroni, 2010, page 277). The water safety approach has a changed rule book by the inclusion of the consequence factor next to the probability factor. The probability factor could be regarded as the continuation of the 'old' flood strategy where the consequence factor of a flood is placed besides it in determining flood risks, reshaping the institution of flood risk management. Organisations have to work with this changed institution in order to create safe environments where there is a close link with the water management domain and the spatial planning domain.

The frame of institutional change can be used to see how policy concepts changed the way of governance practices. *"New concepts have to challenge and shift an array of already routinized governance processes, with their complex mixture of conscious and taken-for-granted modes of practice. New concepts have to 'jump' boundaries and 'break through' resistances, involving implicit and explicit struggles"* (Healey, 2006, page 305). The multi-layer safety approach has shifted the routinized governance process of flood prevention with the inclusion of the probability factor. The new concept of the multi-layer safety approach has to jump and break through boundaries, because it is not only building on technical measures in the prevention of floods. The taken-for-granted mode with technical measures is not suited under the changing conditions of climate and social-economic development. It is transforming the way of governance where *"governance transformation could be identified where a new discursive frame appears and diffuses to a range of arenas with sufficient effect to shift significantly the way resources are allocated and regulatory tools are formulated and used."* (Healey, 2006, page 304)

New policy concepts transform old ways of delivering policy towards the "*institutionalization of a new territorial collective actor with significant authoritative and generative power needs to mobilize and build knowledge resources and relational resources which [..] have the capacity to carry the new ideas, understandings and recognitions of opportunity and struggle through to a wide range of other arenas"* (Healey, 2006, page 307). This quote explains the role of a new collective actor which has the power for the

institutionalization and success of new policy concepts. The most important aspect described by Healey (2006) is the ability to mobilize, build knowledge and relational resources. Moreover, an important aspect for institutionalization is that new ideas, understandings and recognitions of opportunities and struggles are transposed into a wider range of policy arenas.

2.1.2 How institutional change can help understanding changes in FRM

New views on flood risk management have changed the policy for flood risk management. The frame of institutional change is used to see which boundaries have to be jumped and which resistances have to breached for the concept of flood risk management. Combining it with the theory of Moroni, 2010 and North, 1990 it could be set out as how the changing policy (rules of the game) in flood risk management is used by the organizations, combining their skills, strategy and coordination, in reducing the risk of a flood (to win the game).

The success of a new concept depends on 'institutionalization' of the concept in the new practise of flood risk management (Healey, 2006, page 304). The changed policy of flood risk management asks for an institutionalization of new norms and values, where the old way of dealing has been challenged and shifted, to choose a new path of acting. Institutional change can be used to see how organizations adapt with a changing policy on flood risk management and try to land the policy in different policy arenas. For instance, the multi-layer safety approach is linking different policy arenas to establish flood safe environment.

The risk based approach in flood risk management has been proposed, where this risk based approach (probability and consequence reduction) in flood risk management has to become institutionalized. Building on Healey (2006), the risk based approach in flood risk management could be seen as a new approach which proposes a new way of acting with a new kit of tools in the prevention of floods. Adaptation towards the risk based approach in flood risk management "*must become an organizing principle across policy sectors and acted upon in the near term, inviting a focus on how that can be achieved through public policy and administration.*" (Dovers and Hezri, 2010, page 213). This could be seen as working towards a clear path, which is a trajectory in which an institution develops, through political and technical actions in the context of flood risk management; adapting towards a new way of operation. This path builds on specific actions which are enabled by political and institutional measures. Adaptation of a path, then, could be seen as a more local issue reacting on higher level phenomena (Dovers and Hezri, 2010), such as local/regional action for flood control changes under the influence of climate change and national laws. Seeing adaptation of a pathways as a local issue, I assume that different regions can respond differently to higher level changes, because local factors and environmental aspects may influence the effective use of, in this case, nationally proposed flood risk measures.

The focus of institutional change is to see how a new concept crossing over between two, historically separate institutions (e.g. flood risk management and spatial planning) is institutionalized as a new practise for the prevention of floods. Concepts derived from theories about intuitional change offers the opportunity to review the boundaries between pathways which need to be crossed and the resistance to overcome such boundaries. To link institutional change to the design of policy and the tools used in the concept of flood risk management I need an additional theory of path dependency.

2.2 Path dependency

The theory of path dependency is used as an analytical theory in the theoretical framework. Path dependency can help to understand how paths on water safety have changed in time, in order to create flood safe environments. Path-dependency is defined as: *"one whose outcomes evolves as a consequence of the process's or system's own history* (Martin and Sunley, 2006, page 399). This conceptualisation of path dependency corroborates the theory institutional change, in which path dependency can be investigated to study how the institutionalization of a concept results, or not, in new paths. To have a proper understanding of the theory of path dependency I explain the relevant dimensions.

2.2.1 Towards an understanding of path dependency

Path dependency is defined Martin and Sunley, 2006, page 402 as "*...a probabilistic and contingent process: at each moment in historical time the suite of possible future evolutionary trajectories (paths) of a technology, institution, firm or industry is conditioned by (contingent on) both the past and the current states of the system in question. The past thus sets the possibilities, while the present controls what*

possibility is to be explored." North, 1990 expresses path dependence as *"...a way to narrow conceptually the choice set and link decision-making through time. It is not a story of inevitability in which the past neatly predicts the future."* (North, 1990 page 98-99 cited from Martin and Sunley, 2006 page 403).

New policy on flood risk management has a link with the physical safety paradigm from past flood risk management conceptualizations (Hurk et al., 2014). This physical safety paradigm is based on the prevention of floods, which is the main goal of the first layer in the multi-layer safety approach. The policy on path dependency could be seen as a perspective on dynamic increasing returns where *"...the argument that the development of many phenomena is driven by a process of increasing returns, in which various externalities and learning mechanisms operate to produce positive feedback effects, thereby reinforcing existing development paths"* (Martin and Sunley, 2006, page 400). New paths could be created in situations when actors within the process are able to access, understand, and convert knowledge, into new path or renew older ones (Martin and Simmie, 2008).

Path dependency is used to explain how the mechanisms in flood risk management have developed over time and the role of spatial planning in it. *"The path dependency framework is well suited to explaining continuity within distinctive institutional orders by focussing on the unfolding of political processes over time and the mechanisms of positive feedback by which political processes reinforce themselves and in which established policies become locked-in* (Hurk et al., 2014, page 417). New insights in flood risks, and how these flood risks are influenced by changing conditions like socio-demographic changes and climatological changes have resulted in political action on flood risk management. But I suppose that these actions still have a link with the past. For instance, the multi-layer safety approach builds on, and continues with the physical safety paradigm based on the prevention of floods through layer one. The clarification of these political processes, as stated by van den Hurk et al., 2014, might explain how new paths in flood risk management are formed and which obstacles arose during path-creation.

Path dependency can be seen as a set of structuring mechanisms determining a process which keeps evolving towards a particular outcome. Theory about path dependency provides a framework with different mechanisms which might be explored and explained to understand a particular trajectory of institutional change. In order to study how new paths form on top of old paths, Martin and Simmie, 2008 identify four phases of path formation. These four phases of path dependency are:

1. A pre-formation stage;
2. A path creation phase;
3. A lock-in phase;
4. A path dissolution phase (Martin and Sunley, 2010).

2.2.2 The preformation phase

The preformation phase can be seen as the first phase in the formation of new paths. The development of new path does not emerge from out of the blue; already existing structures and paths influence the development of new paths: *"These existing structures and paths – that together constitute the 'preformation phase' – provide the stimulus for, and shape the scope of, new opportunities […] and institutions* (Martin and Simmie, 2008). In the preformation phase first signs of path development can be found. These signs point to opportunities which open up for the development of new institutions, policies and technologies. This stage is characterized by the coexistence of several different options and alternatives without predomination of single options or alternatives (Martin and Simmie, 2008).

2.2.3 Path creation

The creation of paths is caused by events exogenous to the key system properties and could be seen as accidents which break up the old path (Martin and Sunley, 2006). There are different theories to describe such historical accidents. Two major streams of thought are sudden events challenging existing status quo's and deliberate strategic behaviour of actors to realize desired paths. These exogenous drivers or accidents could be understood in flood risk management as climate change or floods. Events like these brought forward the realization to change to flood risk management approach; to create new paths in order to act on new insights in the system of flood risk management.

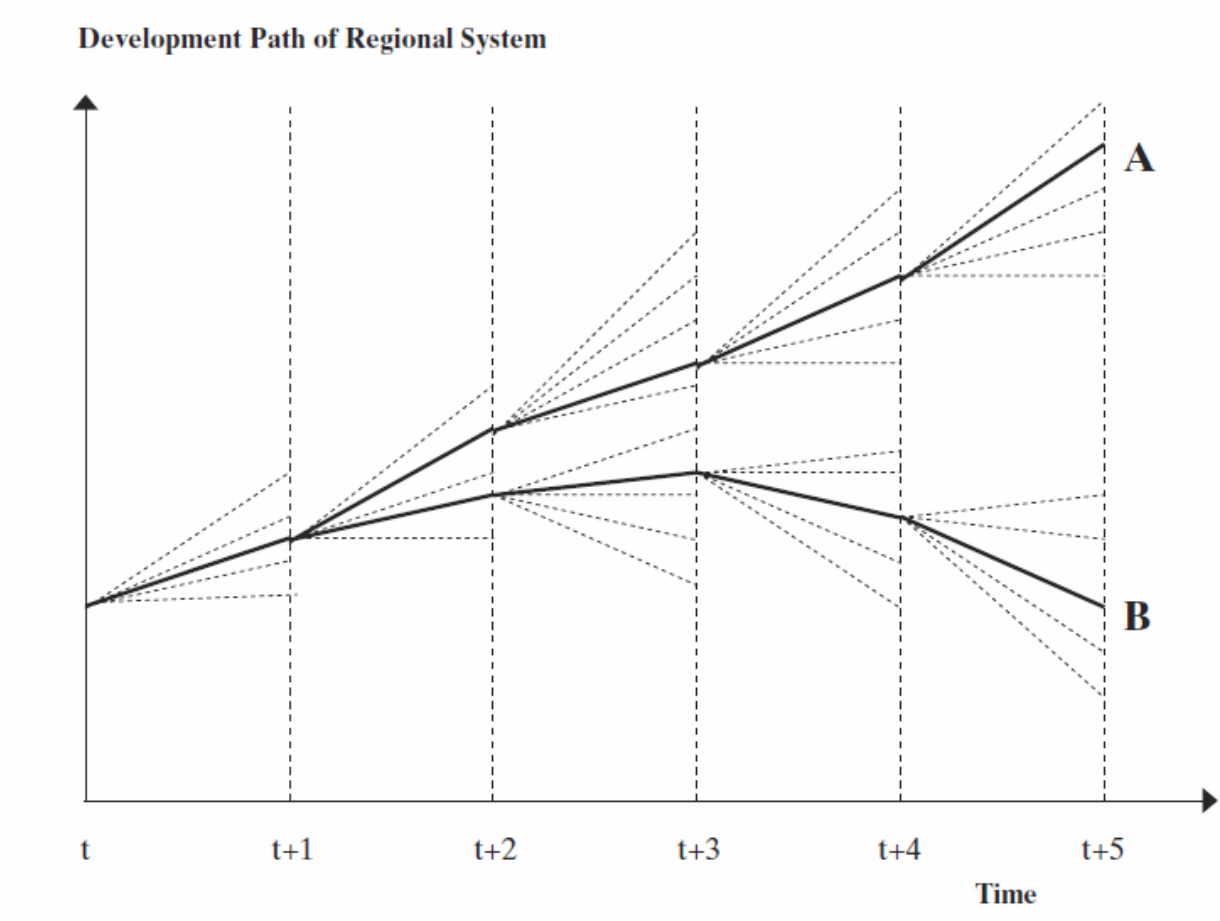
The events that start new paths include the elements of strategic purpose and deliberate action, where David and Puffert, 2000 add to this theory that *"...path dependence is not necessarily an alternative to purposeful strategic action but may actually make actors more eager and motivated to attempt to make their technologies and techniques the basis of a new path or to make their region or locality the home of a new industry* (cited from Martin and Sunley, 2006, page 426).

Garud and Karnøe, 2001 see a significant role for *"the importance of strategic agency and deliberate mindful deviation of entrepreneurs [who] mobilize recourses, ideas, and people in the collective creation of new technological fields* (cited from Martin and Sunley, 2006, page 426). The word entrepreneur originates form the French word *'entreprendre'* which means 'to undertake' (DeLeon, 1996, p. 496, Verduijn, 2014). Schumpeter, 1934 sees an entrepreneur as somebody *"who creates disequilibria to generate innovative change"* (Verduijn, 2014, page 33). A political entrepreneur is described by Dahl, 1961, as *"political leaders who use their resources to the maximum to create political change* (Verduijn, 2014, page 33). Kingdon, 2002, page 122, portrays political entrepreneurs as *"advocates for proposals or for the prominence of ideas"* and emphasizes that *"their defining characteristic is their willingness to invest their resources – time, energy, reputation, and sometimes money, in the hope of a future return"* (cited from Verduijn, 2014, page 34). The role of (an) entrepreneur(s) is important in creation of institutional paths, where their abilities could arrange paths as a new field of operation. An entrepreneur is willing to invest into new ways of operating, to generate innovative change. But I assume it is not only the incitement towards innovation; the implementation of innovation, towards an accepted practise is also a role an entrepreneur has to take in order to create a conditional equilibrium, in which conventional policies become locked-in (Hurk et al., 2014, page 417).

2.2.4 Lock-in

There are different definitions of what a lock-in on a path could be and how this creates path dependency. (Setterfield, 1997) describes a lock-in as *"a conditional equilibrium which has been established by some prior path dependent process and which awaits subsequent redefinition by forces endogenous to the sequential progression* (Martin and Sunley, 2006, page 406). The lock-in follows from the path creation phase were the disequilibria to generate innovative change is arranged into a conditional equilibrium, a lock-in.

(David, 2001, page 26-27) describes a lock-in as *"...the entry of a system into a trapping [configuration] – a basin of attraction that surrounds a locally stable equilibrium...[events] may reasonably be regarded as 'exogenous invitations' (in the state of knowledge or in the regulatory institutional regime), the previous attractor(s) [locked-in configuration(s)] may be destroyed, freeing the system to endogenously begin to evolve some new configuration."* (Martin and Sunley, 2006, page 406). The lock-in is the stable situation but could be undergo changes by the occurrence of a shock-event evolving towards new configurations of the system. In this research the system of flood risk management. External shocks might break-up a lock-in situation or stable equilibrium of path development and cause a negative or positive movement to another path (Martin and Sunley, 2006), see figure 1.



A – Development path with sequential phases of positive lock-in
B – Development path in which positive lock-in becomes negative lock-in
The dashed lines represent fields of possible contingent paths, while solid lines are realised actual paths.
(Martin and Sunley, 2006, page 418)

Figure 1 Alternatives in path-development

2.2.5 Path dependency in FRM

Path dependency can be used to describe a path that is taken within the concept of flood risk management and might be used to examine the mechanisms which work towards water safety, where spatial planning is mirrored within this concept. In the wider policy developed for flood risk management a pool of options exists to improve water safety. Pathway dependency can be used to investigate how different paths to increase water safety develop and the role of spatial planning in the development of water safe environments. Path dependency could offer insight in the interrelationship between flood risk management and spatial planning in the context of developing the flood risk management policy and the realization of adaptive plans (Hetz and Bruns, 2014) to control floods.

The framework of pathway dependency is used to describe the spatial planning mechanisms in flood risk management, which choices are made and how this could be reflected on decision-making in flood risk management on the use of spatial planning. A missing element in this framework is how in the formation of new paths, and efforts to alter course are structured by policy entrepreneurs, which is added to this theory. A third element is necessary to study such effects, for this reason, theory of policy design is added to the theoretical framework. Policy design is used to describe how policy instruments are deliberately used to implement flood risk management policy and alter course in existing institutional paths.

2.3 Policy design

The theory of policy design is used to understand how knowledge, skills and strategy are combined to change institutions into an accepted practise in flood risk management. Policy design theory is used to see how goals on flood risk management are realised and which spatial instruments are used to work towards these goals.

"Policy design involves the deliberate and conscious attempt to define policy goals and connect them to instruments or tools expected to realise those objectives" (Howlett et al., 2015, page 291). *"Policy design is all about the effort to match goals and instruments both within and across areas."* (Howlett, 2009, page 73)

Policy design is studied from the basis of policy formulation where two dimensions are taken into account; (1)policy formulation and (2)policy tools and instruments (Howlett et al., 2015). Policy instruments are the *'tools of government'*, the mechanisms and techniques used to implement or shape policies and institutions (Salamon, 2002, Howlett and Rayner, 2007). Policy instrument choice consists of abstract general aims or goals, along with a set of les abstract objectives which are projected to achieve the aims or goals. The objectives must be incorporated in a set of specific targets or measures which allow policy resources to be directed toward goal achievement (Howlett, 2009). This altogether can affect the current path and can be deliberately effectuated by policy entrepreneurs to direct institutional change onto their desired path. Policy design, thus, has a direct link with path dependency and institutional change, because it offers a theory to study how strategy and entrepreneurship is linked to the shaping and implementation of policy through techniques and mechanisms to formulate and construct policy.

The success of a policy design is determined by the follow three requirements:

1. Policy aims, objectives and targets need to be coherent;
2. Implementation preferences, policy tools and tool calibration should be consistent;
3. Policy aims and implementation preferences; policy objectives and policy tools; and policy targets and tool calibration, should be congruent and convergent (Howlett, 2009, page 73).

These three requirements are taken into account to see if the requirements of success are met and if not where the weak link is in the policy design of flood risk management.

3 Methods

This chapter explains the methods used to conduct this research. The different aspect of the methodology will be explained, concerning the worldview from which this study is executed, the research design, the data collection procedures, data analysis, and validity and reliability.

3.1 Worldview

This study is executed from a post positivist worldview (Creswell, 2014), in the sense that I do not work towards truths or absolute knowledge (Phillips and Burbules, 2000). Instead, I attempt to provide an understanding of the institutional barriers of spatial planning in flood risk management and how this relates to the theories of path dependency and institutional change based on the insights provided form a case study design. The goal of this research is to investigate contribution of spatial planning as risk reductive measure in flood risk management. Alongside the institutional barriers of spatial planning as risk reductive measure, as well as insights in the arguments about adequate spatial planning measures in reducing the risk of a flood. This research is based on observing and measuring spatial planning in the domain of flood risk management in order to understand which institutional barriers exist and which path dependent processes in flood risk management exist and how spatial planning measures and tools play a role in these processes.

3.2 Qualitative case study research

This research is based on cases to interpret the role of spatial planning in flood risk management. Thomas, 2011, page 17 defines case studies as followed;

> *"Case studies are analyses of persons, events, decisions, periods, projects, policies, institutions, other systems that are studied holistically by one or more methods. The case that is the subject of the inquiry will be an instance of a class of phenomena that provides an analytical frame –an object- within which the study is conducted and which the case illuminates and explicates."*

The subject of the cases in this study is spatial planning in flood risk management, analysed within the analytical frame -the object- of institutional change, path dependency and policy design. Case studies are chosen to gain an in-depth understanding of the role of spatial planning in flood risk management. Case studies can provide an in-depth understanding of specific social phenomena (Yin, 2009). The use of Yin is in conflict with the post-positivist worldview of this research, because Yin is considered as a positivist. However, certain elements could still be used for explaining features of case study design via the theory of Yin.

Case studies can provide context dependent knowledge, as a crucial part in understanding phenomena which cannot be understood by general rules (Flyvbjerg, 2001). The research is explicitly qualitative and builds on 'interpretation':

> *"…the researcher draws meaning from the findings of data analysis. This meaning may result in lessons learned, information to compare with the literature, or personal experiences."* (Creswell, 2014, p.244)

The cases are selected from two different starting points in flood risk management policy, namely the Room for the River programme and the multi-layer safety approach. These two starting points help in answering the role of a changed institutions in relation to the role of spatial planning and in what way these changed institutions are influenced or influence (by) path dependency and how this results in (new) policy design. The meaning is drawn from the cases studied and answered with the first three sub-research questions and are translated to a case comparison where the conclusions are drawn on spatial planning in flood risk management.

The dashed line in figure 2 represents a feedback loop. In this research the theoretical lens has been adjusted due to insights about the different cases investigated (Yin, 2009). Within this feedback loop the theoretical lens has been reframed in order to have a better link with the data from the cases investigated.

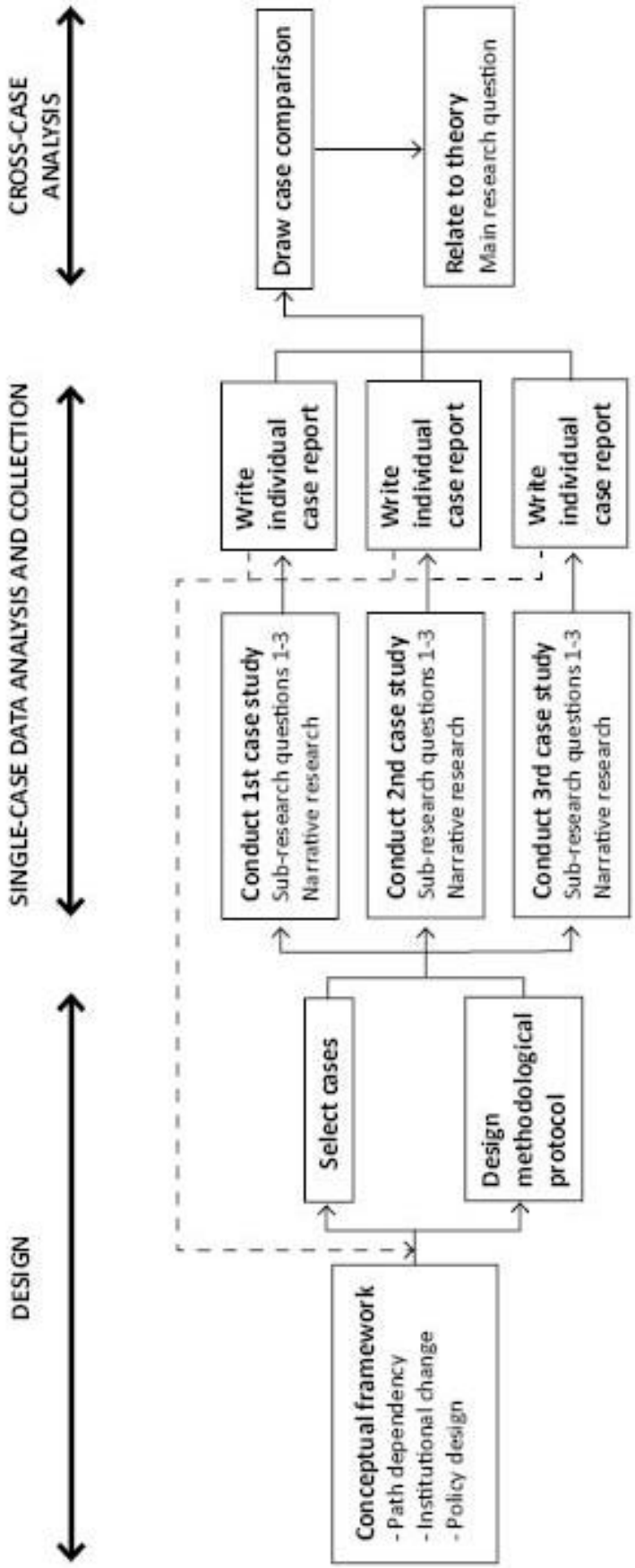


Figure 2 Case study method, based on (Yin, 2009, p.57)

3.3 Case study selection

The cases selected in this research had to comply with several criteria. First, the cases should have a spatial planning component and a water safety component. This first criterion is assuring that there is a spatial planning component in a flood risk management project/process. Second, the cases are selected from a river based perspective. The largest possibility on floods from the river system has given urgency to water safety against the dangers from changing river discharges and to act upon from an adaptive basis instead of a reactive basis. This changing approach could be used to see how spatial planning has changed with it and to see which obstacles have to be jumped in order to make this change work. Third, the cases should have a clear path of development on water safety, where the spatial planning domain is investigated in these paths.

The research is based on the investigation of different cases. I have used three cases in this research in order to be able to make a comparison between the different cases, but still be able to investigate the cases on a qualitative basis.

3.4 Data collection procedures

The data collected consists of three types. First, qualitative, semi-structured in-depth interviews. The choice for in-depth interviews is based on the advantages of this type of data where the respondent is asked about the *"facts of a matter as well as their opinions about events [together with the proposition of] her or his own insights into certain occurrences."* (Yin, 2009, p. 107). The in-depth interviews are semi structured, in order to have room for opinions and insights and to ask for further explanation if necessary. A pitfall of this type of interviewing, *"the interpersonal influence"* (Yin, 2009, p. 107), is limited with the use of other sources to verify the insights and search for contrary evidence (Yin, 2009). These other sources used are policy documents, newspaper articles and other interviewees. Insights form interviews are used as input for following interviews to have a weighted insight.

Another source of data are qualitative documents as policy documents and scientific articles. The policy documents are used as guidance for the in-depth interviews. The interpretations and analysis of the researcher from the policy documents are used to set up the interview in order to get a reflection, interpretation and analysis from the actor itself. The scientific articles are used to develop a view on spatial planning in flood risk management and how the domain of spatial planning has been evolving in the domain of flood risk management. These documents are also used to see which interpretations and analysis are drawn in these articles and if they are in line with the interpretations and analysis of the researcher. Third, is the use of newspaper articles and websites. These data sources are used to get information from another point of view on the case or to get clarification on lacking information. In one case, the newspaper is used as source of information to get clarification on why there was resistance on in-depth interviews.

3.5 Analysis and interpretation

Data in this research is organised and themed with the use of codes, in order to segment and take apart the data. The richness and density of the information is 'winnowed' (Guest et al., 2012) with the use of codes and themes (Creswell, 2014). The programme Atlas.ti is used for analysing the data.

Coding has been set up according to the themes in this research. Coding for the 'multi-layer safety approach' has been assembled according the three layers of this approach; 'MLS 1' (preventive measures), 'MLS 2' (spatial planning), 'MLS 3' (evacuation strategies). This coding strategy has a clear link with the multi-layer safety approach, but flood risk management measures not relate to the multi-layer safety approach, are coded with this set of codes as well. This is done to see if there were also multi-layer safety influences or links between the different domains from the multi-layer safety approach, even if there was no clear strategy to develop from the multi-layer safety approach. This coding strategy was used to see if it was possible to see a link between the domains of water management (layer one) and spatial planning (layer 2). Other themes are 'policy design', where the codes of 'policy goal', 'policy objective', 'strategy', 'tools' and 'measures' are part of. These codes are focusing on the link of strategy and tools and are based on the previous set of codes about the multi-layer safety approach. The multi-layer safety approach comes with a certain development strategy, and the codes of policy design could help to interpret the strategy versus tools to identify (missing) links. Institutional change has been coded with '(institutional) barriers' and relate to the (missing) links of policy design. Path dependency has been coded according 'path', 'spatial planning (perspective)', 'water management (perspective)'. These codes are mainly used to identify from which

perspective the flood risk management policy is approached, which paths of development is chosen, which could have an indirect link with the multi-layer safety perspective; prevention, spatial planning or evacuation, which have a link to strategy and tools and which have (institutional) barriers that have to be overcome.

The themes in this research are linked to the theoretical lens of this study and are translated into the major findings in this study, which *"should display multiple perspectives from individuals and should be supported by diverse quotations and specific evidence"* (Creswell, 2014, p. 200). The themes in this research are represented in a qualitative narrative, by using narrative passages, quotations and arguments to convey the finding of the analysis (Creswell, 2014).

3.6 Validity and reliability

Validity of the research is based on the accuracy of the findings (Gibbs, 2007, in Creswell, 2014). The following strategies are used to achieve this:

- Triangulation by using different data sources and to develop *converging lines of inquiry* (Yin, 2009). These data sources are used to converge the themes of this research form different sources of data and participants (Creswell, 2014), as stated in the chapter of data collection;
- Member checking by giving the interviewees the chance to reflect on the accuracy and providing an opportunity to comment on the findings in this research (Creswell, 2014);
- A rich and thick description of the findings by providing a detailed description of the findings (Creswell, 2014).

Reliability is based on the consistent approach across different researches and projects (Gibbs, 2007, in Creswell, 2014). The procedures of the cases need to be clear by documenting the steps of the procedures (Yin, 2009, in Creswell, 2014). In this research this is achieved by introducing the different elements spatial planning on water safety and by reflecting on the theories at the end of each case. These steps are used to work towards my cross-case analysis and general findings.

4 Case study

In the following chapter will elaborated upon the cases investigated in this research. All the cases are build up in same order where I first start with the provincial view on the flood risk management. This view provides the first insights in how policy on water safety is translated towards a regional implementation on flood risk management. The next step is to zoom more into detail on the case with a project which has a link with spatial planning and water management within the domain of flood risk management. Here the views of the municipality, the water board and the engineering companies are used to get a closer view on the implementation of flood risk management. At the end of each case the theoretical framework is reviewed according the theories of this research on spatial planning in flood risk management.

4.1 The Maasvallei

The river Meuse is a rainwater fed river which causes large fluctuations in the river its water levels. High quantities of rainfall in the river basin, cause high water level in the river. Climate change is affecting precipitation to become more extreme, enlarging the water quantities of the river. Together with a stringent target, based on the progressive insights on the long term perspective, the flood risk management system of the Meuse has to be adapted to secure safety.

In the Maasvallei, literally Meuse Valley, the river Meuse shaped the riverbed through the hilly region into a wide valley. The edge of the river bed is formed by high grounds. Beyond this natural edge, the effects of floods are much smaller compared to the diked areas of the river Meuse (Ministerie van Verkeer en Waterstaat and Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2006). The Maasvallei is only partially protected by dikes and there is no continuous dike system. In total, the dike system in the river Meuse in the Dutch province of Limburg exists out of 40 separate so-called dike rings (Berkhof A.M. et al., 2013). Typical for this area are the so-called Maaskaden (Meuse bunds), these bunds are low walls providing some flood protection, but which can flood during (extreme) high water levels.

Strategies are part of the institutional change theory as in how the *combination of skills, strategy, and coordination* (North, 1990, cited from Moroni, 2010, page 277) could lead to the implementation of a changed flood risk management policy. The strategy does also have a link with path dependency and institutional change. The situation in the river Meuse in Limburg is unique and therefore its study could provide new insights on how strategies in flood risk management could make the region flood proof for the future. The complex situation of inner and outer dike areas asks for appropriate responsibilities and sets of measures, because there are a lot of inhabited areas outside the dikes which have to cope with high water levels and high flood frequencies (Ministerie van Infrastructuur en Milieu, 2013). Diking these areas is no option because of the consequences for downstream riverfront areas. Measures need to be found pre-eminently in the second and third layer of the multi-layer safety approach. The hardest effort on the implementation of measures from the second and third layer of the multi-layer safety approach lies within the responsibility and funding of these measures (Ministerie van Infrastructuur en Milieu, 2013). The first part of this case analysis focusses on a provincial level perspective on flood risk management. From there on the specific case of the Willem Alexanderhaven in the city of Roermond, is studied, because the multi-layer safety approach has been part on the conceptualisation of plans for multi-layer safety.

How water safety is influencing spatial development

The province of Limburg initiated the development of the Maasvallei (Berkhof A.M. et al., 2013) gave insight on their flood risk management perspective. The biggest task for the Province of Limburg on flood risk management is to update the flood defence system according to the new safety norms. The highest priority is given to measures for the prevention of floods. As the Policy Officer on water of the Province of Limburg states:

> *"… in the Province of Limburg a large task lies within the fulfilment of the safety norm with measures from the first layer, and we not yet finished it. Here we need to make the biggest effort now and that is not different from most parts of the Netherlands. Many politicians choose to accord to the safety task from the first layer and from there on they look further."* (Provincie Limburg)

Differentiation of safety norms

The unique situation in the river Meuse asks for a specific approach on the acceptance of activities in the riverbed, linked to the levels of safety norms.

> *"For the Limburgse Maas, it is a unique system with bunds* [red lines in figure 3] *in the riverbed. These bunds provide safety for water levels once every 250 years. The municipalities take into account these safety levels, meaning that protection is provided by these bunds. But the Department of Waterways and Public Works (Rijkswaterstaat) takes into account a normative discharge of 1 to 1250, the national safety norm. With a 1/1250 discharge, the bunds will flood resulting in a riverbed which is much wider than these bunds suggest. The water will reach further than these bunds with a normative discharge of 1/1250."* (Rijkswaterstaat Zuid-Nederland)

The usage of different safety norms does inflict the projected long term perspective of the river discharges and the edges of the river bed. The discharges that are yardstick for the future of the river Meuse by a norm of 1/250 are; 3275m^3/s as reference situation, towards 3615m^3/s in 2050, and 3950m^3/s in 2100 (Berkhof A.M. et al., 2013). The projected river discharge in 2100 by the Beleidslijn Grote Rivieren, 2006 (National Policy Objective for the Large Rivers) is 4600m^3/s with a norm of 1/1250 (Ministerie van Verkeer en Waterstaat and Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2006), as the highest possible discharge. With a 1/250 norm the Meuse bunds are the edge of the riverbed, but with a higher norm the riverbed lies beyond these bunds, where the edge of inner dike and outer dike becomes unclear.

This difference in approach of the river discharges does also inflict the possibility on spatial development in the riverbed, namely a discharge regime is limiting the options for spatial development and the difference in borders could mean the difference between development or not. The buffer regime does also have limitations on development, because the discharging and the buffering part of the river have to be kept preserved:

> *"There will be a new system in the approach of the safety norms, where we don't have two safety regimes in the riverbed anymore."* (RWS Zuid-Nederland)

Compliance with the safety norms

The target year to comply with the new norms on flood protection is 2024, where the new safety norm is set on a probability of flooding 1/250 a year. But in 2017, new norms are going to be set again, and these have to be met by 2050. The compliance with these safety norms is developed through different stages:

> *"We already anticipate the new safety norms with current dike reinforcement projects. At this moment dikes are made wide enough, wider than necessary, to raise the dike in the future more easily. The height of the dike cannot be adjusted to the newest norms yet. Compensatory measures are needed, because dike heightening causes more water to pass by, because less water can enter the diked retention areas, resulting in higher water levels downstream."* (Provincie Limburg)

Policy on river management for the Meuse will be affected by climate change, to which the river management regime should be adapted. As a project leader at Arcadis, mentions:

> *"In the future we will get more extreme weather. More extreme weather means heavier rainfall in a short period of time, resulting in larger discharges. On the other side, longer periods of drought will occur. We will have to cope both with periods of drought and periods of extreme discharges. In times of drought, or drier circumstances, you want to retain water in the region as long as possible, with the use of water retention areas or flood plains. In times of heavy rainfall, you want to discharge water as fast as possible. This is achieved by giving more space to the river. You try to preserve the standard river bed, where you give space to the river in times of peak discharges, by widening the river profile."* (Arcadis)

Different policies programmes have been set up to work towards a riverbed which is able to discharge water safely, but could also buffer water for dry periods. Water safety, river regimes and spatial development are intertwined in this area. I want to highlight some key features of the National Policy Objective for the Large Rivers high influence on developments in the region of the Maasvallei.

The National Policy Objective for the Large Rivers has set a policy on activities in the riverbed. The main objectives of this policy are:

- To keep the discharging and buffering part of the river preserved;
- Blocking developments which make the possibility of river enlargements by widening and deepening now and in the future factual impossible (Ministerie van Verkeer en Waterstaat and Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2006).

The National Policy Objective for the Large Rivers offers a systematic framework to determine the assessment context and the conditions of the river system for spatial initiatives within the riverbed (Ministerie van Verkeer en Waterstaat and Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2006). Within the normative parameters of high water levels, different situations occur in river based circumstances. These circumstances differ from place to place and ask for a differentiated assessment on the

permission of activities in the riverbed (Ministerie van Verkeer en Waterstaat and Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2006). The differentiation in the riverbed is made by a discharging regime and buffering regime. Under the header of the discharging regime are only so called riverine activities allowed.

Figure 3 depicts the different regimes in the river Meuse near the city of Roermond (located on the middle left near the river). Blue is the discharging regime where only riverine activities are allowed. Green is the buffering regime which is offering more opportunities for development, but has still some limitations. The yellow part is the where the 6D article is in place.

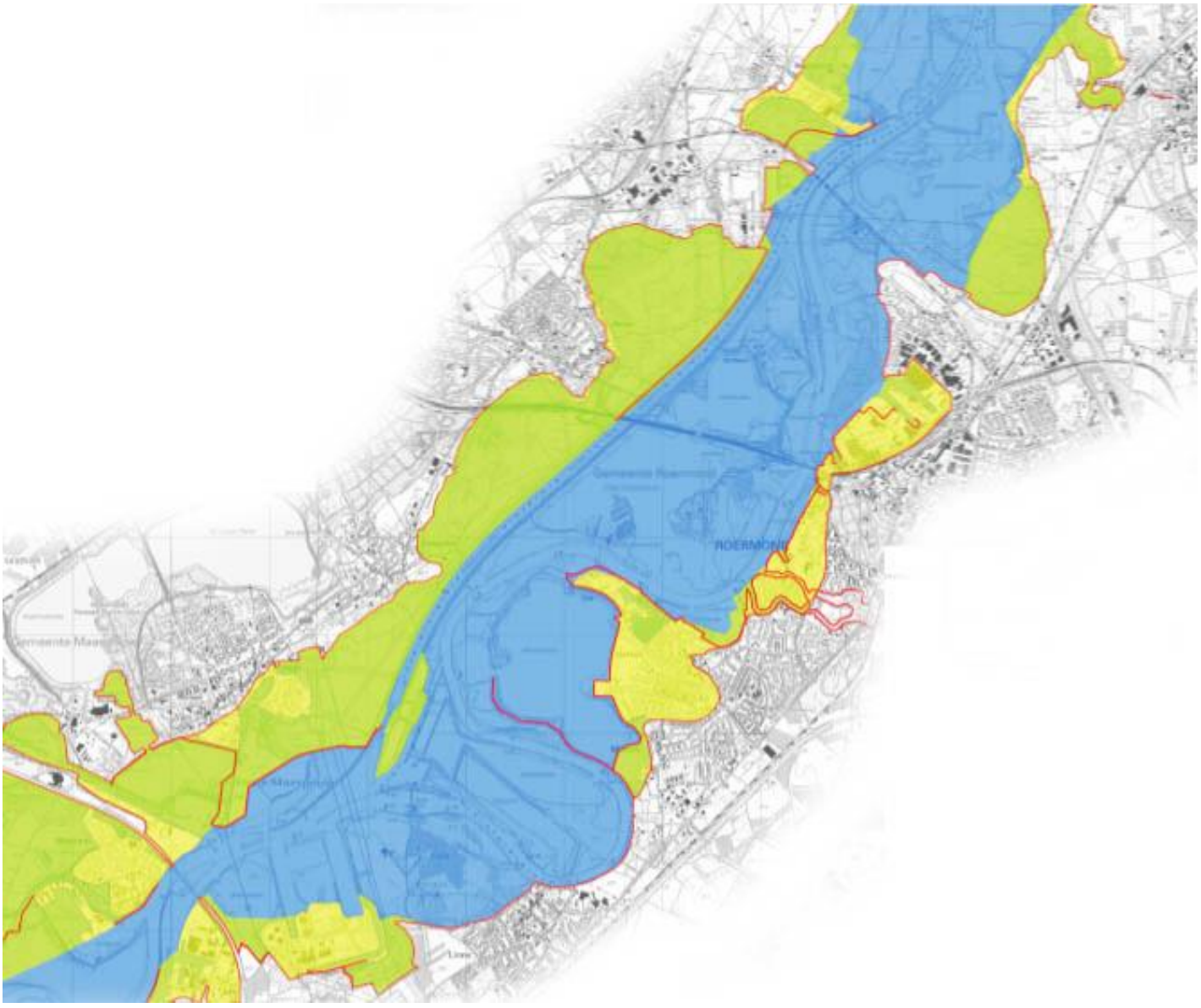


Figure 3 The different regimes in the river Meuse near the city of Roermond (National Policy Objective Large Rivers)

Article 6 of the National Policy Objective for the Large Rivers appoints the rules for non-riverine developments in the discharging regime of the riverbed. The "no-unless" rule of the discharging regime is setting the boundaries on development in the riverbed. This rule describes the types of development as followed:

> *Non-riverine activities in the part of the riverbed, where the discharging regime is applied, will not be authorized, unless there is a large public importance and the activity cannot be realised outside the riverbed.* (Ministerie van Verkeer en Waterstaat and Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2006)
>
> An addition to this article 6 is de 6D of the Policy Objective for Large Rivers:
>
> *Non-riverine activities which realise a sustainable expansion of the discharge capacity and/or the buffering capacity, are permitted. These activities could act as a cost carrier for measures of which structurally the discharge or buffering capacity of the existing riverbed can be expanded. The realisation of these initiatives adds to the policy objective of 'Room for the River'. The nature and extent of river widening has to be in proportion to the operation and has to be located on a suited location form a river point of view.* ***The initiator is carrying the full responsibility of the costs of the river widening measure*** *[…] River widening is achieved by widening the existing riverbed through the relocation of dikes, the construction of a buffer area or flood bypass channel, the partially removal of obstacles, fully or partially excavation of flood proof terrains.* (Ministerie van Verkeer en Waterstaat and Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2006)

The spatial development in the area is limited because the area is under influence of the river regimes. Spatial development is only possible when it realises a sustainable expansion of the discharge capacity and/or the buffering capacity. Also the initiator of is carrying the full responsibility of the costs for the river widening measure. Spatial development in the riverbed area therefore becomes more complicated, because the initiator is carrying the costs of the river widening measures as well as the costs of the spatial development; projects become much more expensive.

Flood risk challenges and flood risk policy

In order to work with the changed institutions on flood risk management, in this case the changed system of safety norms and linked to this the river system regimes, a basic set of rules has been set up for the Maasvallei:

- The basic principle is: space where possible, dikes where necessary.
- Combination of measures has to lead to a robust and sustainable system; based on river widening and dike reinforcements.
- Linking of flood risk management with spatial developments to enlarge the spatial quality and regional economic development.
- Build upon existing plans of river widening and dike reinforcements, where there is a link with the long term perspective (no regret); linking the short-term programmes with long term perspectives.
- The realisation of the legal safety norms (current and new) will be developed from the prevention on floods (layer one) (Berkhof A.M. et al., 2013).

The institutional framework for flood risk management in the Maasvallei is focused on dike reinforcement and river widening. However, the flood protection task proposes big challenges in the future. Especially on sections where the trajectory of the Meuse is narrow combined with high concentrations of population and high economic values (Berkhof A.M. et al., 2013). But the focus is still on river widening and dike reinforcements and is seen as threat for flood risk management in the future (Berkhof A.M. et al., 2013).

Development in the river Meuse in Limburg, especially in the non-diked area of the river, faced difficulties on spatial developments in and next to the riverbed, as a result of the legislation on water safety. This was named the '6D discussion', linked to the D addition of the 6th article of the National Policy Objective for the Large Rivers. To get some grip on the restrictions of this article, forces were bundled in an inter-municipal structural alliance. As the municipality of Roermond, states:

> *"The Department of Waterways and Public Works (RWS), the province of Limburg, and several municipalities have set up a trajectory to be able to come up to common understanding and therewith to obtain developments within the frames of the 'blue' and 'green' prerequisites."*

The blue and green prerequisites refer to the regimes in the riverbed, namely the discharging regime (blue) and the buffering regime (green). Development is restricted in these regimes of the riverbed, with a hard no-unless rule for the discharging regime (the 6th article of the National Policy Objective for the Large Rivers) and more soft measure of yes-if rule for the buffering regime. But it applies in both regimes that before you can even talk about development, you have to take countervailing measures, and as stated in addition D of the 6th article, the initiator is carrying the full responsibility for the costs of the river widening measures (Ministerie van Verkeer en Waterstaat and Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2006). This 6th article locks the path for the development in the riverbed area, because the costs of spatial development in the riverbed becomes much more expensive due to these full responsibilities on the costs of countervailing measures.

Restrictions on spatial development and the continuous development towards more stringent safety norms, together with the unique situation of the Maasvallei are demanding new concepts for flood risk management. These new approaches are developed, but the processes do not reach further than ideas on paper. New approaches on flood risk management are still in their infancy.

> *"You could say that multi-layer safety is still in its infancy in the province of Limburg. We would like to do more with it, but the focus is on the achievement of the safety norm in the first layer. […] We could do more than just river widening. We could say that all houses in the outer dike areas should be built on two-meter-high poles or mount. But that does not come off the ground. A lot of money has to be invested, where the province does not want to do this single handed."* (Provincie Limburg)

A concrete example on multi-layer safety is the use of evacuation bridges for dike rings that will be completely surrounded by water in times of high water levels.

> *"Evacuation bridges could be seen as a concrete example of multi-layer safety, but is remains as an idea on paper. […] The province has a rich plea for these evacuation bridges. It should be done, but the built of it costs money. Then the parties look at each other and nothing happens besides dike reinforcements."* (Provincie Limburg)

Conflicts on water safety and spatial development

To get more into detail about spatial planning and flood risk management, the city of Roermond and the case of the Willem-Alexanderhaven (the local harbour) can be looked at. The harbour is located in a naturally narrow part of the Meuse riverbed where a high concentration of inhabitants and high economic values converge (Berkhof A.M. et al., 2013). The Willem-Alexanderhaven is going to be developed from a harbour area and industrial site towards a high dynamic urban location for small and medium enterprises, together with residential areas. It is designated as experimental area to apply the multi-layer safety approach (Ministerie van Infrastructuur en Milieu, 2013) which is conceptualized through the plan of Jazz-city.

This case builds upon the water safety task for the Willem-Alexanderhaven combined with the spatial transition of this area.

> *"The development of Jazz-City has to become an attractive and dynamic location for the visitors of the city of Roermond. Jazz-City has to excite the visitors of the Designer Outlet to remain longer in the city and has to offer the residents form the city/region a new dynamic and flourishing waterfront. […] An important element for Jazz-City is the relation with water."* (Jazz City B.V., 2012, page 5)

The transition of the harbour area, spatial development, is combined a water safety task. The height of the dock walls did not meet the safety norms and had to be updated in order to meet the safety norms. Different measures have been developed in order to achieve the norms; a ring dike, a flood plain parks and an integral raise of the area. The development of water safety could go hand in hand with the spatial developments in the area, linking water safety with the spatial planning; aimed at developing a dynamic and flourishing waterfront.

> *"This experimental area is thereby the only one where, on location level, insights are generated about the so-called smart combinations.* (Wing, 2013, page 37)

For Jazz City, smart combinations investigated for the following strategies:

- A ring dike (layer 1: prevention)
- Integral heightening of the area (layer 2: spatial planning)
- Floodplain park (combination of layer 1 and 2 with a dike, and water robust development with a mix of buildings, green and water) (Wing, 2013, page 37)

The different strategies on water safety have been assessed on spatial quality and practicability (e.g. financial aspects). The combination of water safety and spatial planning, the smart combination, has been used to see how administrative considerations can be made on water safety in relation to spatial planning (Wing, 2013). Smart combinations are made from a multi-layer safety perspective in line with the plans of Jazz City.

The focus of the spatial plan is on practicability, costs, rate of execution; together with the different options for achieving the water safety norms. These conditions resulted in an ideal situation achieved through a mix of two measures, those of an integral raise of the area together with a flood plain park (Waterschap Peel en Maasvallei and Wing, not dated). The link with spatial development and water safety has been made, but the implementation of these water safety measures never took place, for which different reasons have been put forward by the project developers, namely the costs and rate of execution. The inclusion of a multi-layer safety approach in this plan meant the whole plan had to be revaluated, resulting in a delayed construction. The inclusion of the multi-layer safety approach was not within the focus of the plan, this focus was based on practicability, costs and rate of execution.

The multi-layer safety approach has been introduced in a stadium where major changes were not possible anymore, the concept of multi-layer water safety could not be included in the plans for Jazz City.

> *"Many ideas for the use of multi-layer safety have been put forward in this case, but [the process] was already gone beyond that phase. It was not possible to modify of plan's design to the optimal situation on smart combinations. An important question is how to put the optimal situation into practise."* (Rijkswaterstaat Zuid-Nederland)

The implementation of water safety measures in the area has been influenced by policy dilemmas on the long term perspective of a development vision for Jazz City; the position in the region and its unicity. This has been contrasted with the short term policy focus perspective on development. These two implications have influenced the implementation of water safety measures in the area (Waterschap Peel en Maasvallei and Wing, not dated). The plan of Jazz city is bound to the investments of real-estate developers and legal embedding in developments plans. Opportunities for developing inventive safety strategies in the form of a dike ring, integral heightening or floodplain park were missed. The current development model of Jazz City is not based long term perspectives, but on the short term benefits of real estate development. Knowledge on water, spatial planning and water safety are not integrally included in the plan making (Wing, 2013, page 37). Calculations have been made on the integral heightening of the area and the construction of a floodplain park. Both measures have been proven to be cost effective and the floodplain park enhances the attractiveness of the urban environment (Berkhof A.M. et al., 2013). But the water safety aspect has not been achieved with one of these measures.

The water safety norm is achieved by a new sheet piling wall (damwand) and partially by heightening the area. The new sheet piling wall is developed with the use of the Flood Protection Programme (HWBP: HoogWaterBeschermingsProgramma).

> *"Investments in the HWBP will be made relatively soon, but apart from any partial reinforcements that have shorter lifecycles, the measures (i.e. investments in infrastructure) will generally have to be long term, often expanding into the late 21st century. For an effective approach then, it is important that all tasks and ambitions are being considered and other types of solutions investigated. This requires an adaptive approach by explicitly linking short-term decisions to long term tasking, setting the best time for investment opportunities and connecting different investment*

> *agendas."* (The Ministry of Infrastructure and the Environment and The Ministry of Economic Affairs, 2013, page 15)

Building the sheet piling wall has been advanced in order to develop the wall with funds of the HWBP. The HWBP has set conditions on development from their funds. It has to be sober and practical.

> *"Sober means that only the costs of the measure to meet the new safety standard and the legal integration in the area are eligibility of subsidies."* (Hoogwaterbeschermingsprogramma, 2014, page 27)

The wall is realised with the principle of sober and practical, but it deviates from the policy focus and the concepts vision, in which the relation with the waterfront had high priority.

> *"The sheet piling wall has been put forward partially because of spatial initiatives and partially because of financial reasons. In this way it was possible to get co-finances [from the HWBP programme] and thereby the realisation from a sober and practical interpretation."* (Municipality of Roermond)

But question marks could be placed if the short-term decisions have been linked with the long term tasks. Indeed, the water safety norm has been achieved with the construction of a sheet piling wall with investments form the HWBP, but it has also *"frustrated the optimal consideration* [of the Jazz City plan]*; no relation with water* [due to the sheet pilling wall]*."* (Waterschap Peel en Maasvallei and Wing, not dated)

For the case of Jazz City different ways of flood protection are investigated. As described in the water plan of Jazz city, the heightening of the area, together with an elevated road as possible evacuation route, parking garages which have waterproof doors and will be constructed as water pressure proof buildings and made waterproof by the use of waterproof materials (Royal HasKoningDHV, 2013). Together with a link on water safety and spatial planning, the smart combination, it could have been an interesting case to investigate more into detail.

The case of Jazz-City has political overtones with the involvement of Alderman Jos van Rey, who is accused of corruption and fraud, together with real-estate developer Piet van Pol, who has a link with Jos van Rey and the development of Jazz City.

Het Financiële Dagblad, 16 januari, 2015: Vastgoedman Piet van Pol kocht volgens het OM twee VVD-wethouders om; Wethouder Jos van Rey ontving bijna 100.000 aan cadeaus en gunsten van Pol

Limburgs Dagblad, 9 maart 2015: Mapje 'Van Pol vertrouwelijk' bij Van Rey

The development of amusement park Yumble, located in the Willem-Alexanderhaven, did not work out as planned. The park had to close its doors four months after opening, a major setback for this area. Water safety measures, in the form of a sheet piling wall, have been brought forward because the spatial initiative in the form of the development of this amusement park. The development rate of Yumble and the sheet piling wall was conflicting the optimal solutions on water safety and the considerations on the relation with water (Waterschap Peel en Maasvallei and Wing, not dated).

Dagblad de Limburger, 23 juli 2015: Yumble blijkt zeepbel; de deur van Yumble Roermond is na vier maanden gesloten.

From here on, the political overtones in this case led the research of the development of this area astray. Questioning for sensitive information put me in disrepute and the political sensitivity behind the development let to accusations of 'fishing' for sensitive information. More in-depth information about the case of developing the Alexanderhaven was beyond any reach after this deadlock, where I could not research the link between spatial planning and water management further.

Theoretical reflection

Pathway dependency

The province of Limburg continues to follow the path of flood protection by dikes. The current safety norms are reached through dike reinforcements and an adaptive strategy by building the dikes wider to make a raise in the future more easily. On the long term, safety norms are projected to be achieved with river widening measures and dike heightening (Berkhof A.M. et al., 2013).

The discussion about both long term and short term is key point on multi-layer safety development in the Province of Limburg, and the Maasvallei. Policy makers are focussing on fast results on water safety in the short term. Compliance to the safety norms is bound to a strict deadline, which has to be achieved. The new safety norms will be put on the agenda in 2017 and have to be met in 2050. The path towards these safety norms has been set out with another dike reinforcement and river widening (see figure 4).

The focus on river widening measures and dike heightening could cause new threats for the river Meuse in Limburg and especially the Maasvallei in the long term. Dike heightening could create a larger water column, because water is not given more space but pushed up between two dikes in the situation where the same riverbed has to cope with more water. Also the effect of piping, when water flows underneath the foundation of the dikes, enlarges the possibility of a dike breach (Dienst Landelijk Gebied, 2012). Consequential is a changed water safety aspect; a dike breach forces a larger water volume into the hinterland, causing larger areas to be flooded or higher flood levels, enlarging the consequences of a flood (Dienst Landelijk Gebied, 2012); (Berkhof A.M. et al., 2013).

In the river trajectories where dike heightening will be implemented, the outer dike areas alongside these river trajectories will have to deal with higher water levels and higher frequencies of flooding (Berkhof A.M. et al., 2013). The hydraulic bottlenecks remain when current dikes are heightened. These bottlenecks do not only have to cope with higher water levels, but also higher flow rates, enlarging the consequences of a flood.

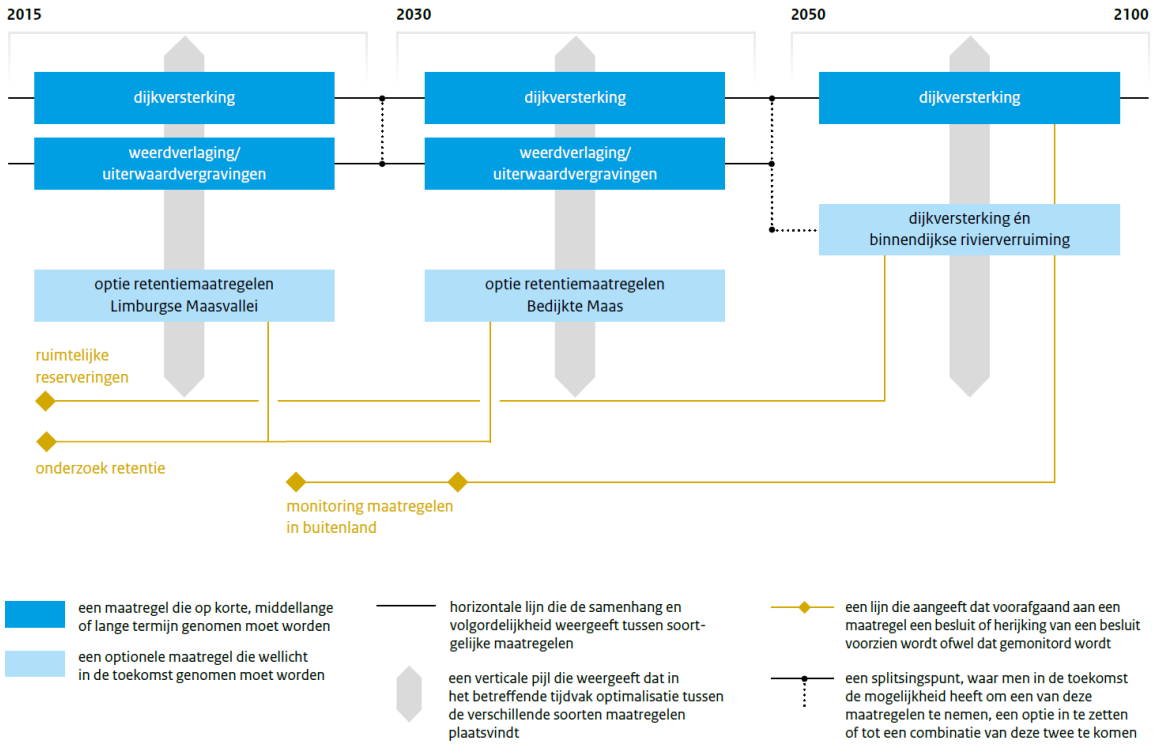


Figure 4 Long term policy on water safety for the river Meuse (Deltaprogramma 2015, page 58)

The unique situation in the Maasvallei is that certain dike rings will flood during high water levels. Some of these dike rings are functioning as retention areas, but the policy on this form of retention is not a robust and reliable solution (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). Changes in the water system of the Maasvallei involve a changed juridical status of these dike rings in relation to spatial planning (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). The floodable dike rings are insufficient on robustness and because of the changed juridical status, from retention to non-retention the rules of spatial planning in these dike rings has changed as well. Also, the edges of the riverbed change, due to different perceptions on the safety norms. The safety norms have to be developed conform the national safety norms, 1:1250 (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). This results in a larger restricted area for development, because the discharging and retention areas in the riverbed become larger with this safety norm, influencing the spatial planning system; article 6 from National Policy Objective Large Rivers. Urban developments and restructuring have to anticipate on future dike reinforcements in order to work towards qualitative sophisticated and organic implementation of dikes in urban areas (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a).

New rules within the policy of flood risk management opposed difficulties on (spatial) developments in the riverbed. New restricting rules are demanding new paths of development for the institutionalization on this policy of flood risk management, new ways of dealing with the protection against floods.

> *"The safety norm is obtained with measures from the first layer. Measures from the second and third layer are used primarily for the reduction of residual risks. The Maasvallei has a relatively large outer dike area with buildings and therewith a continuous risk on damage and victims. River widening is necessary to keep the risk on the same level and where possible reduce it. The residual risk can be lowered even further with outer dike measures from the second and third layer [of the multi-layer safety approach].* (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a, page 15)

Path dependency is mostly based on the cost effective strategy of water safety measures (Buuren et al., 2015). The categorisation of safety measures is based on a short term perspective, considered as which measure are most cost effective at this moment. Resulting in the continuation on measures from the first layer, based on cost effectiveness. Due to investments from the past in this first layer. This results in path dependent development on the prevention of floods with measures from the first layer. This is also the case in the Province of Limburg where the focus lies on short term results aimed at compliance with the safety norms. Investments are already made by widening the dikes more than necessary, to heighten the dike more easily in the future. The multi-layer safety approach could have a promising operation if there is a long term consideration (Buuren et al., 2015).

The unclear long term effects of climate change, the safety norms, and how multi-layer safety should be financed, are locking the path ways on flood risk management. The system of flood risk management in Limburg has entered a trapped configuration, a lock-in. Actors already see external shocks as a solution to overcome this lock-in (Martin and Sunley, 2006):

> *"Maybe another emergency situation is needed to show the necessity. [...] Authorities will act in times of a threatening situation. […] It is actually a bit harsh, but the near-floods of 1993 and 1995 acted as an incentive or catalyst for the implementation of measures. This would also go up for the implementation of measures from the second and third layer. After the floods of 1995 a lot has happened; dikes are built and river widening measures applied."* (Provincie Limburg)

This approach of external threats as catalysers of change, however, is still based on a reaction on floods in which flood risk reducing measures are implemented only after a flood occurs. The national policy deliberately aims at overcoming such strategies by embracing an adaptive approach to flood risk, in which the government plans ahead to prevent floods from happening altogether.

If you look at the case of the Willem-Alexanderhaven, you could determine two paths of development. First the development of the build-up area, the former harbour area. Second, the development of water safety in the area. For the case of the Alexanderhaven the analysis showed that the pathway of the build-up area was already in a lock-in on the development of Jazz City. The development of Jazz City was bound to the real

estate developers and investors, together with zoning and land-use plans (Waterschap Peel en Maasvallei and Wing, not dated). Rijkswaterstaat indeed recognised this lock-in on spatial planning mechanisms:

> *"The use of multi-layer safety is depending on area development and you have to deal with land-use plans and real estate developers, what already decided on the place bounded developments in the area. It was not possible to shift the outlook of the area towards the most optimal outlook [on water safety]."* (Rijkswaterstaat Zuid-Nederland)

Moreover, the process for Jazz City already proceeded so far into the formal procedures that no major changes could be made in the development plan. Accounting for multi-layer safety in the preformation phase, would enable the implementation of new paths for the development of water safety for the Alexanderhaven. The insertion of the multi-layer safety approach in the development of the Willem-Alexanderhaven could have offered new opportunities for this area, but would also delay the development. The smart combinations investigated in the context of the multi-layer safety approach for the Alexanderhaven could be seen as developments in the preformation phase, because the different alternatives in the concept co-existed in this stage.

Institutional change

The changed institution of flood risk management has caused resistance. The changing policies on water, and especially the concept of multi-layer safety, have not shifted the routinized governance processes. The concept of multi-layer safety does not fit within the 'old way' of dealing with flood risk management. The analysis shows that the missing link for the institutionalization of the new concept of multi-layer safety is a collective actor with the ability to mobilize and build knowledge resources (e.g. Healey, 2006). Organisations are looking at each other for the implementation of new concepts. The changed rules on how the game of flood risk management has to be played is not fully accepted by the organisations which have to work with it. They are looking for alternatives in the rules to see if their ideas somehow could be developed, weaving the 'new' rules within the 'old' rules. This could be concretised with the Policy Objective for Large Rivers which is of large influence on spatial development in the riverbed. The river regimes of this policy and linked safety norms could be seen as the 'new' rules and inflicting the possibilities of spatial development, if no compensating measures are taken. Because the spatial strategy is building on the 'old' rules, the result is a collision between a water policy and spatial policy.

Until national policy is more transparent about finances and how safety norms will develop on the long term, the attitude towards multi-layer safety is based on waiting with the result that opportunities are missed. This attitude is in opposition to the effort of the national government for the implementation of the multi-layer safety approach, which is explicitly based on an open and learning method on the basis of pilots and under the auspices of decentral governments, whereas the national government will participate actively in these pilots (Buuren et al., 2015).

One of the demands for path way creation is building upon entrepreneurs, where (Garud and Karnøe, 2001) see a significant role *"to the importance of strategic agency and deliberate mindful deviation of entrepreneurs [who] mobilize recourses, ideas, and people in the collective creation of new technological fields* (cited from (Martin and Sunley, 2006, page 426). In this case, the changed policy in flood risk management could be linked to new technological fields on how to approach flood risk and a new field of operation from the multi-layer safety approach from Martin and Sunley, 2006, but it is hard to distinguish how new concepts have challenged and shifted the governance processes in the Maasvallei. The combination of skills, strategy and coordination is missing on the link between water safety and spatial planning; it is not clear what strategies have been set out for the long term development of the Maasvallei. Most developments on water safety have a short term perspective: trying to achieve the safety norms of 2020. For the long term dike reinforcement and river widening are options deliberately kept open. This is causing threats for spatial development, locked by the safety norms of 1/1250 from the National Policy on Large Rivers. The regimes of the national policy lock the spatial development with certain preconditions on (spatial) development. The combination of skills, strategy and coordination, where different governmental layers work together, could change the hard National Policy on Large Rivers into new ways of operating. But there is a missing link, an entrepreneur.

A collective actor or entrepreneur could contribute to the acceptance of the concept. Actors were looking at each other, waiting for clear guidance on the practice and operationalization of the multi-layer safety

approach. The path on flood risk management has to be set out by entrepreneurs, otherwise it will stay in the path of preformation and it will not become a routinization of accepted practice, it will not become institutionalised.

Entrepreneurship is an important missing factor in the case of multi-layer water safety in the Maasvallei in the Province of Limburg. Also, in the case of the Meuse discussed here, the role of the province of Limburg did not function as such while you could consider their role in binding the fields of spatial planning and water management. *"A stronger role for provinces is advocated, to enhance complementarity with water management and ensure alignment with overall policies."* (OECD, 2014, p. 25) Multi-layer safety is based upon synchronising spatial planning and flood protection, however, the province of Limburg did not have nor take the directing role to actively synchronise these two domains (Buuren et al., 2015). The multi-layer safety approach could play a role in water management for this region, but it only stayed so far with ideas on paper. *"There is a difference between changing policies on paper and changing policies on the ground"* (Huitema and Meijerink, 2010, page 4). The next step as said before asks for an entrepreneur to guide this practice into implementation.

Policy design

As Howlett et al., 2015, p. 291, describes; *"policy design involves the deliberate and conscious attempt to define policy goals and connect them to instruments or tools expected to realise those objectives."* The connection is not being made between policy goals and the tools to realise the objectives on water safety, locking the path in ideas on paper and not being realised. The policy goals have been set in the form of river based principles for the Maasvallei, a set of principles linking water safety and water safety policy to spatial planning. The following step is connecting these goals to instruments and tools in order to put them into practise, meaning to connect them through the *mobilization to that of routinization as accepted practices, and beyond that to broadly accepted cultural norms and values."* (Healey, 2006, page 304), resulting is a widely carried practise on water safety where parties work together and where the province is not operating single handed, and provide a flood risk management system which is not focussing on river widening and dike reinforcement.

4.2 The IJsseldelta-Zuid

The IJsseldelta is a low lying area which is located between the IJsselmeer, the river IJssel, which mouths into the Ketelmeer and the river of the Zwarte Water which mouths into the Zwarte Meer Lake. The rivers are strongly connected with the surrounding landscape, which is typified by openness, high cultural historic values, old parcelling patterns and farmhouses on mounts (Rijkswaterstaat, 2009).

The low lying area of the IJsseldelta is susceptible for the climatological impact on high river discharges, and influenced by high water levels in the IJsselmeer Lake. The first priority in the region is to update all dykes to the necessary standards. This is done within the Flood Protection Programme (HWBP: HoogWaterBeschermingsProgramma). To make the region future proof for large river discharges the program Room for the River has opted a bypass, as an extra outflow in times of high river discharges, and the excavation of the summer riverbed in the river IJssel. Together, these two measures must regulate a substantive water level declination and have to make this region able to cope the prospected river discharges (Sokolewicz et al., 2011).

The project of the IJsseldelta-Zuid started in the year 2004, and was initiated by the Province of Overijssel as a response to the projected measures for an increase in the discharge capacity of the river IJssel (Rijkswaterstaat, 2013). The IJsseldelta-Zuid, part of the Room for the River Programme, is the area where the water safety aspect for the region is enlarged by deepening the riverbed of the IJssel and the construction of a bypass from the river IJssel towards the IJsselmeer lake.

The programme of Room for the River is focussed on the moderation of extreme water levels by giving space to water (Planologische Kernbeslissing Ruimte voor de rivier, 2006). This is achieved by the relocation of dikes, lowered floodplains and cleaned up obstacles in the river profile. The river profile is maintained by dredging proceedings and there are rules which impose restraints on outer dike building (Ministerie van Verkeer en Waterstaat et al., 2009).

In the IJsseldelta-Zuid, the spatial planning domain is linked to the water safety domain. These two domains are integrated in one large masterplan, combining water safety with spatial planning and (regional) development. Land use changes in relation to the prevention of floods *"offer clear advantages when considered as part of a strategy for integrated development of the river corridor that aims to optimize more than one function and takes into account nature and landscape values"* (Hooijer et al., 2004).

The water safety task is integrated with the spatial planning task, as a so called smart combination. Added to the different developments on water safety are issues according spatial development, like recreation, agriculture, housing and nature.

Explanation of terms

I want to explain the terms used in this chapter to have a clear understanding in the different options of high water channels. The technical differences of these high water channels are important for the case of the IJsseldelta-Zuid because it has a close link with other (spatial) developments in the area.

High water channel: A high water channel is not dug, but shaped by the construction of two dikes in the landscape (Pols et al., 2007). The channel is a branch from the river and will be used to discharge water via another route in times of high water situations (Planologische Kernbeslissing Ruimte voor de rivier, 2006), enlarging the discharge capacity of the river.

Green high water channel: A high water channel which will only discharge in times of high water situations (Pols et al., 2007). Other land use configurations are possible under normal situations.

Blue high water channel: A permanent water carrying channel (Pols et al., 2007), and could function as an extra discharge channel in times of high water. This type of high water channel is also indicated with the term bypass for the case of the IJsseldelta-Zuid.

Bypass: The term bypass is linked to the blue high water channel and refers to a continuous water carrying stream, which is water bearing, passable by boat and could function as an extra discharge channel in times of high river discharges.

How water safety is achieved in the IJsseldelta-Zuid

The project of IJsseldelta-Zuid consists of finding a solution for the water issues and spatial tasks in the region. Via different scoping studies and explorations the long term effects influencing the water safety in the region have been made clear (Brink and Hidding, 2009). The project of the IJsseldelta-Zuid has to protect the region against flooding. Climatological changes could flood this area and to prevent this from happening, two major water safety measures are set up to get a large water level decline in the river IJssel and to reduce the risk of flooding (Sokolewicz et al., 2011). The discharge capacity of the river is increased by two projects; 1. deepening the riverbed of the IJssel and 2. the construction of a bypass or high water channel, an extra river branch from the river IJssel towards the border lakes of the IJsselmeer Lake (Brink and Hidding, 2009).

The development of the bypass goes along with other developments in the region, like the construction of the Hanze rail line, the upgrading of the provincial road N50 towards a fully-fledged highway and the development of 4000 houses for the municipality of Kampen (Brink and Hidding, 2009; Sokolewicz et al., 2011). Besides these developments are the spatial demands for nature development, recreation and reinforcement of the agricultural structures (Brink and Hidding, 2009).

The developments in this are area converged in one integral plan for this area of which the province is the initiator (Brink and Hidding, 2009). To explain the main aspects of this plan I use the interview with the project leader for the IJsseldelta-Zuid at the Province of Overijssel. The plan of the IJsseldelta-Zuid is undergoing changes and information from available (policy) documents is not accurate anymore. Therefore, I use his information to introduce this case.

The first plans for the IJsseldelta-Zuid date back to the year 2004, when the first preparations have been taken for the programme Room for the River. Water protection in this region had to be achieved with a high water channel, complemented with the wishes for spatial development from different governments as well. The national policy came up with the idea of a high water channel in the downstream area of the IJssel to tackle the projected water issues. In the PKB part one, the high water channel has been set as the most sustainable solution. However, the total budget for the Room for the River project was set at 2,2 billion euro and the high water channel in the IJsseldelta alone was already estimated at 300 million euro. Together with other large projects in the Room for the River programme, like the dike relocation near Lent, the high water channel Veessen-Wapenveld and the Noordwaard at Werkendam, all projects which are in the same range of 300-350 million euros, a large part of the budget for this programme was already filled in.

Therefore, the national policy came up with the plan to replace the construction of the high water channel in the IJsseldelta by deepening the riverbed of the IJssel over the course of 21 kilometres by one meter. This was enough to reach the needed declination of the water level as set in the PKB. The deepening of the riverbed was an investment of 46 million euros.

In the PKB an option was included about an exchangeable resolution (omwisselbesluit) for development of the high water channel, presupposing a number of conditions could be fulfilled, namely; the assurance of 300 million euros for the costs of the high water channel, and the spatial security must be ensured via a regional plan amendment and an outline development plan for the development of the high water channel.

This exchangeable resolution has encouraged the region by the means of a regional development plan, to integrate the different targets for this region into one integral plan on water safety combined with the targets on improving the spatial quality for the region. The integral plan combined the different targets for the region; the water safety task for the region in the form of a high water channel, targets on improving the spatial quality, and the regional targets regarding nature, recreation and a unique residential environment linked to a passable bypass.

The spatial quality is conceptualised in the PKB Ruimte voor de Rivier as followed:

> *"The improvement of the spatial quality is the achievement of an attractive and functional environment, which is also of value in the future. […] The concept of spatial quality has to be translated towards the specific areal qualities of the area."* (Planologische Kernbeslissing Ruimte voor de rivier, 2006)

This broad definition made it possible to link different development targets to the concept of spatial quality as stated in the PKB Room for the River. For the region of the IJsseldelta multiple targets have been set; water safety, targets on spatial quality and regional targets as regards nature, recreation and the possibility to develop a special real-estate area, if the bypass would be passable.

The integral plan of the high water channel has six targets; nature, recreation, house-building, improvement of the infrastructure, spatial adaptation of the Hanzelijn and strengthening of the agricultural sector. The justification of the integral plan for the high water channel, together with an investment of 100 million euros from the province for these targets and the accelerated implementation of the high water channel, made the national government decide to finance the project from the Room for the River programme. The high water channel is planned be developed in two phases; phase one, the complete deepening of the summer bed of the river IJssel in combination with the arrangements for the bypass, combining the development of the new dikes in the area with the excavated sand from the river deepening, saving 30 million euros, and phase two, which has to take place in 2020, where the water management structures will be built for the operation of the high water channel as an addition to the deepened river bed for the discharge of high water peaks.

In the meantime, the conditions in the hydraulic system changed. An extra decrease of the water levels in the river IJssel was needed, from 29 cm towards 41 cm as a political decision. This meant an extra 70 cm deepening of the riverbed, from 1 meter towards 1,70 meters. The extra lowering the riverbed of the IJssel, resulted in a lowered water level under normal discharge conditions and this had a particular bearing on the surrounding area.

The first effect was that a water extraction area would be contaminated because a stable emplacement is disrupted due to changing groundwater levels and flows, causing a contaminated flow from this emplacement into the water extraction area. To prevent this from happening an extra investment of 32 million euros was needed for compensation. Secondly, the project was not licensable on the basis of the nature protection law. The floodplains of the river IJssel are Natura 2000 areas. As a result of a lowered water level in the river, achieved by deepening the riverbed, the floodplains will inundate less often, affecting endangered species in this area, which would partly disappear. Compensation was not possible because of the large surface effected by riverbed deepening. The third effect was the contribution against desiccation of the Veluwe and Sallandse Heuvelrug. It would require huge investments to carry water back to the area or to keep the groundwater levels on the same level.

To reach the necessary decrease in water level, a proposal has been made to deepen the riverbed with 1,70 meter in the last seven kilometre of the river IJssel. Within the last seven kilometres, the water level of the IJsselmeer is the determining factor under normal discharging circumstances of the river IJssel. It is calculated that this measure will provide 21 centimetres of the necessary 41 centimetres in water level decrease. As a complementary measure, some water management structures from phase two of the high water channel will be built in advance, resulting in the remainder 20 centimetres of water level decrease.

> *"In the beginning, the riverbed deepening and the bypass competed with each other. The initiative of the region was to do an area development. This area development planning did not evolve fast enough for the PKB Room for the River programme, and within the programme the targets had been set on riverbed deepening. […] The riverbed deepening caused problems related to a water catchment area, resulting in a shortened river bed deepening trajectory and the loss of few centimetres in water level declination, where the bypass popped up again to fill in these losses."* (Rijkswaterstaat)

The tough conditions of the PKB, and especially on the exchange solution of the high water channel, did put a lot of pressure on the complex area development. A long process has eventually led to the development of a high water channel together with improvement of the spatial qualities, resulting a water safe and attractive area.

Different positions on water safety

Water safety is in the region is achieved by a combination of measures; river bed deepening and a bypass (see figure 5). The measures on water safety have shifted a lot, due to new insights. Different positions have been adopted on how water safety should be achieved in the area.

Riverbed deepening is seen as a short term measure, with a high factor on maintenance.

> *"Riverbed deepening is digging a hole in the riverbed. You always have to dig, it is not something structurally, not a sustainable solution. But the development of riverbed deepening is relatively cheap. The other side of the equation is you have to dredge for eternity."* (Rijkswaterstaat)

But another position on riverbed dredging has been put forward by the province of Overijssel:

> *"This deepening was only sufficient for a river discharge of 18.000 cubic meters per second. This discharge level is prospected for the year 2025 and the next measure on water safety in the region was the high water channel. Together with the wish to develop real estate, and the ambitions for nature and recreation, a spatial reservation was made for the high water channel to prevent capital intensive investments [in the planned area for this high water channel]*."

Most positions have been adopted on the plan for the bypass. The plan for the bypass, has been debated according to storylines as described by Hajer, 2010, p. 106:

- *"The bypass was not necessary, because it was only a long term solution (for after 2050) and alternatives would be found before then. The municipality of Kampen in particular questioned the need for the bypass;*
- *Protecting the area from flooding is in theory the responsibility of the Ministry of Transport, Public Works and Water Management. Dredging the IJssel costs 40 million euros, while a navigable bypass would cost between 250 and 300 million euros. The ministry has decided not to drop the dredging option in favour of the constructing the bypass earlier, unless the regional authorities could demonstrate that it was financially and technically feasible. Earlier construction of the bypass did mean, however, that the regional authorities would have to contribute to the costs, while the costs of dredging now and constructing the bypass later would be borne by the ministry;*
- *If dredging was no longer a viable option, a 'green' bypass could be constructed, i.e. a bypass that does not permanently contain water. This would consist of two green dikes crossing the Hanzelijn. The bypass would only fill up at high water –which occurs once every 500 years- and then only for two weeks. In that period the Hanzelijn would be out of operation."*

These storylines are used as describe the story of unnecessity of a 'blue' bypass. (Hajer, 1995), suggest that storylines attract new actors, referred to as 'affinity' "…*a concept that stresses the importance of jointly developing a fresh vision in coalition building."* (Huitema and Meijerink, 2010, page 5). This affinity is used to build a coalition against the construction against a 'blue' bypass.

The province of Overijssel had different reasons for an advanced development of the high water channel, namely:

1. Besides the improvement of the water safety in the region, it is better to do it all in once. The implementation of the high water channel can be integrated and better adjusted to other developments in the area. Therefore, the area is only under construction once.
2. If the high water channel is part of the short term measures of the PKB Room for the river, the flood protection can be developed in the form of a bypass and the spatial quality in the area can be improved (Brink and Hidding, 2009).

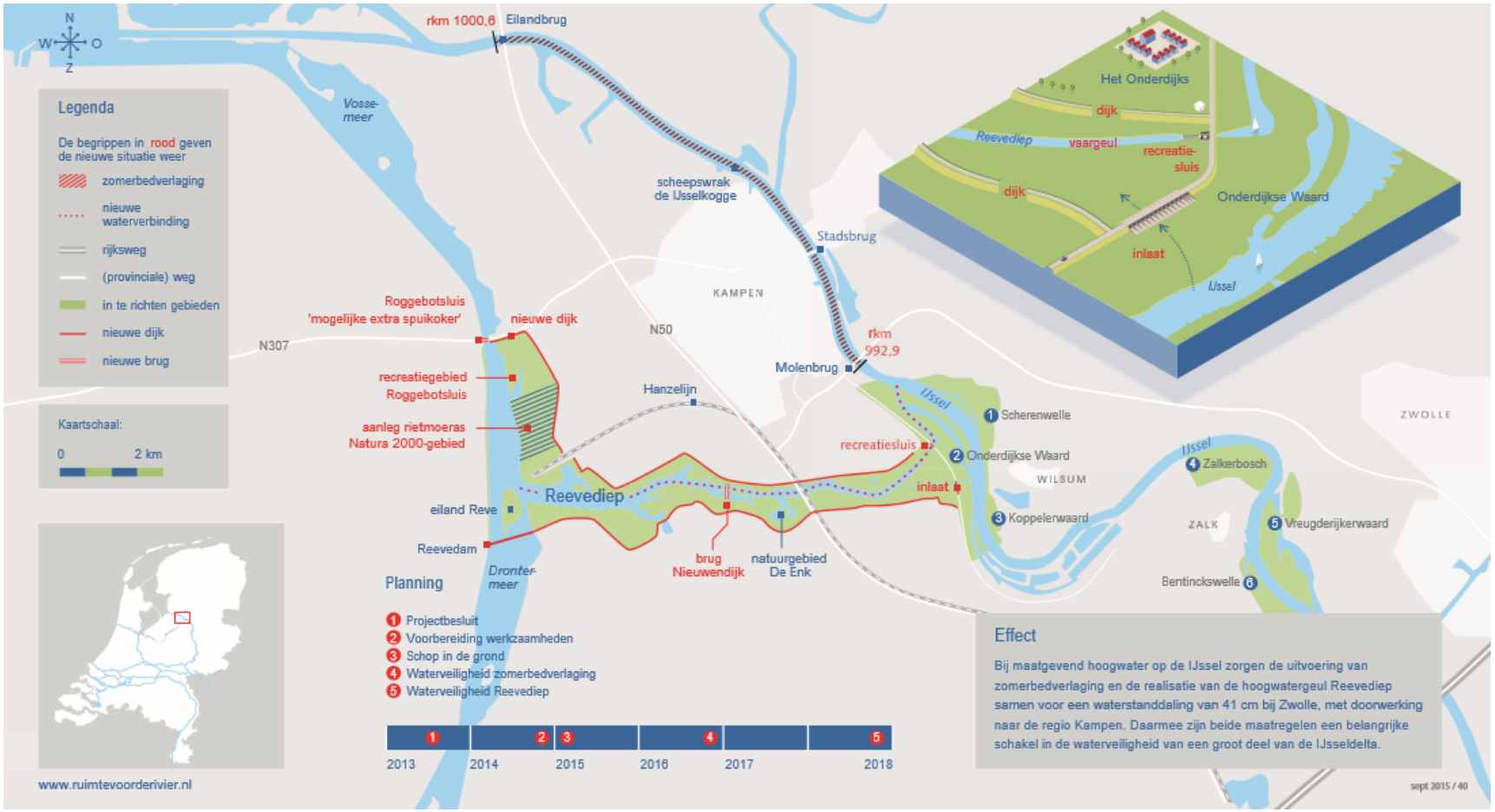


Figure 5 Overview of the bypass and the riverbed deepening

The blue and green high water channel have been investigated for the IJsseldelta-Zuid and different arguments have been put forward in the comparison of these two options. The water board of Groot Salland describes the different types of a high water channels in comparison to the development and how this relates to the implementation of it in the area.

> *"The water board was aiming for a green bypass [a green high water channel] instead of a blue bypass, because the bypass in planned in a low moor polder area, with a small peat layer. […] A green bypass is in favour of the farmers in the area, because they can continue with their businesses and the advantage for the water system is that there is no waterlogging into the polder.*
>
> *The bypass is made blue because of the linkage with other developments in the area, like recreation, nature development, and real estate development. The water level in the blue bypass is determined by the water level in the IJsselmeer. Because the bypass is situated in a low lying polder the bypass is higher than its surrounding landscape. The result is that the bypass is causing seepage into the polder and therefore additional measures have to be taken to control the seepage to the polder area."*

Rijkswaterstaat sees an advantage in a blue bypass:

> *"Water [from the waterway] on water [high water discharge] causes less resistance in comparison to grass [from a green bypass], so the water drains more easily."*

The development of the bypass is a highly technical implication and this is sometimes in conflict with design. As Tauw describes:

> *"The bypass cuts through the water system in the area [the water system discharges northwards and the bypass has an east-west direction]. The water system had to be redesigned partially. […] It is a technical intervention – technical issues with a lot of ifs and buts and margins – pioneering towards a functional water system; and if it does not function as designed, it can be adjusted, but it is technically soluble."*
>
> *"Idea making, plan making and management is very important, but it has a consequence for the smallest technical application. For instance, the dredged sediment from the riverbed deepening, is not necessarily suitable for building the dikes of the bypass. If it is possible to make it suitable, you probably have to adjust the outlook of your dikes. This means that space has to be left open in the plan for adjustments, but leaving space open for the adjustment of dikes is not done easily – they wanted a closed plan."*

The focus on technical implication of the hydraulic system, solving problems with a technical intervention, is not based on a sustainable solution according to the water board of Groot-Salland:

> *"Water, as the hydraulic system, will be pumped away; problem solving by using extra pumps. Seepage is taking place into eternity, because that is what is happening; the polder is located below sea level and the water level is conditioned to the water levels in the IJsselmeer. The water levels in the IJsselmeer are higher than the polder and the water level in the polder. If you bring in the water from the IJsselmeer, it will infiltrate [in the bypass area]. The result is seepage and this has to be pumped around daily for eternity. That is the capstone for this solution, which is not a sustainable solution nowadays."*

The difficulty of the bypass is based on the hydraulic settings, the technical solvability of the issues in the bypass, the flexibility of the plan and the link with other developments.

> *"The term bypass is introduced to make a distinction on the content of developments concerning nature and recreational measures, where a high water channel is purely a trivial channel to discharge water."* (Provincie Overijssel)

The areal development of the IJsseldelta-Zuid is incorporated as a model in the National Spatial Strategy (Nota Ruimte), where the most important aspects of the masterplan are the bypass and the real estate

development southwest of the city of Kampen (Tauw et al., 2012), linking water safety with spatial planning. Together with the development of the bypass, an environment is created were next to space for water; nature, recreation, living and improvement of the infrastructure are incorporated via integral area development (Tauw et al., 2012). The link of spatial developments in the area together with the water safety task has always been a disputed issue.

> *"Within the area of the IJsseldelta-Zuid, an area development waged before the PKB, Room for the River. It was a proper area development, but very quickly the water safety issues have been put on the agenda. If we do an area development without taking into account the safe discharge of water, something might go wrong."* (Rijkswaterstaat)

The processes on the water safety task has changed a lot. Especially the hydraulic system; a bypass or riverbed widening and the link with an area development.

> *"The hydraulic models showed that the bypass alone was not sufficient enough to get the projected water level decline. The result is a combination of a bypass with a riverbed deepening, but always depending on the total area development, and it has successfully been reached."* (Provincie Overijssel)

The focus on area development did face opposition. The following quote makes clear how the area development did overrule the hydraulic and water safety issues.

> *"The project of the IJsseldelta-Zuid is a spatial development project with a link to water safety in order to legitimise and develop [measures in the spatial domain]. It goes about an area development and from it is the result water level decline, a nicely legitimization of the story. This could be drawn from the departments of the province of Overijssel directing the project; all came from the department of space not from water. The departments on water are barely involved in the project. […] The project reaches goals on water safety, but that is only target. […] It is about the realisation of a nice project, water safety is a nice incentive and that is fantastic, but in the realization it plays a subordinate role. […] The storm barrier near the Roggebotsluis has only be implemented in the plan to have lower dikes. But a storm barrier could fail or not function. Costs: 60-70 million euros to save 30-40cm of dike height. But this 30-40 cm is not even noticeable in the open field. It is about incomprehension and not being heard; to not take into account the water safety, too little by all means. Whilst this project has been set up for the safety of the region, quite frankly.* (Waterschap Groot Salland)

The project has always been set up with a focus on the area development. But this focus on area development did also put a lot of pressure on the project. As stated before the exchangeable solution made it possible to link different strategies on spatial quality. But this exchangeable solution made it look like the spatial development was more important. The integral plan has *"…always been depending on the total area development"* (Provincie Overijssel).

Integral plan making

The integral plan of the IJsseldelta has two main targets; ensure the water safety in the region and improving the region with different spatial developments. The spatial developments are linked to the water safety task for the region. A project linking water management and spatial planning, where water is defined as the binding force and the platform for the masterplan IJsseldelta-Zuid (Brink and Hidding, 2009).

The field of water management, as stated in the PKB Room for the River, is a classical procedure of projects and is focussed on the realisation of a coherent and cost effective package with measures for various reasons. The river area has important riverine, environmental and ecological coherence and the programme of Room for the River has limited financial sources, whereby it is necessary to take the most cost efficient measures, to reach as much water level decline as possible (Brink and Hidding, 2009). This argues for a strong central direction and for the formulation of hard non-negotiable prerequisites to which river relief measures have to compete (Brink and Hidding, 2009) (Brink and Meijerink, 2006) .

> *"The development of the project is depending on the programmes in which it will be developed, what are the deadlines and what are the funds? Room for the River had a fixed deadline and fixed*

funds and within these boundaries developments had to take place; what will be guiding the limits of the project?" (Tauw)

The classical procedure of the PKB room for the river is based upon a government approach of planning, but the exchange solution for the high water channel together with the possibility to improve the spatial quality has opened up the classical procedure, and allows more leeway, resulting in a more governance approach (Brink and Hidding, 2009). As emphasized by the Province of Overijssel, the possibility to link water safety with spatial quality within the PKB made it possible to link all the different targets for this region, into one integral plan.

The area development is characterized by a regional approach and an integral spatial character; a development of a coherent, widespread and integrated area concept (Brink and Hidding, 2009). The area development is an endeavour based on the so called 'IJsselse Maat', meaning the solutions on water safety have to meet the characteristics of the river IJssel; small scale, inner dike areas intertwined with outer dike areas, environmental and natural values, economic and historic cityscapes (Ministerie Infrastructuur en Milieu and Ministerie Economische Zaken, 2014). The starting point of the area development and its process in the IJsseldelta-Zuid is bound to the exchange solution and the conditions of it, of which the safety norm on floods is the most important one, and investigated on the technical feasibility of the bypass (Brink and Hidding, 2009).

The connection between water and space is also were the friction between those two fields is. The connection of a water safety task with spatial planning linked **a wish** on spatial development for the area and **a need** on water safety, with a **long term perspective** on water safety and a **short term perspective**, in the programme Room for the River with short term intentions. The spatial improvements in the region of the integral plan are based on a short term perspective, where development of the bypass is based on a long term perspective. In full operation, the bypass is offering protection against discharges reached in 2050 (Hajer et al., 2010), and has even a perspective towards the year 2065 (Rijkswaterstaat, 2013).

The integral plan for the IJsseldelta-Zuid connects water safety and spatial planning. "*The integral plan of the high water channel has six targets; nature, recreation, house-building, improvement of the infrastructure, spatial adaptation of the Hanzelijn and strengthening of the agricultural sector."* (Provincie Overijssel)

The six targets of the IJsseldelta-Zuid could be divided into different spatial entities. Infrastructure, the Hanzelijn and strengthening the agriculture had to be adjusted, because the bypass was of influence on these fields. Nature, recreation and house-building have a direct connection with the bypass and benefit from the bypass; making these domains stronger in the region. The goals of nature, recreation and house-building could be fitted in the Room for the River programme under the header of spatial quality. *"In the Netherlands, rivers have been rediscovered as beauty and enjoyment spots. Houses facing the river can fetch much higher rents and property prices, while recreational facilities by the water promise ready uptake for leisure activities. To encompass all these disparate meanings of rivers, language strategies can be pursued and in the Room for the River program this was done by closely connecting water safety with 'spatial quality'."* (Warner and van Buuren, 2011, page 778)

The link of water safety and spatial planning changed the plan making towards an integral approach. The project of the IJsseldelta-Zuid has been put forward as an area development project (Brink and Hidding, 2009) (Hajer et al., 2010). Area development is typified in the first place by an area faced character and has to act as bridge between plan making and the implementation. Development planning has to be understood as the aim of adding new development power to spatial planning under changed circumstances(Brink and Hidding, 2009). The province of Overijssel has put forward the project of the IJsseldelta as a leading project on development planning, where the PKB Room for the River place a central role (Brink and Hidding, 2009) linking water safety and spatial planning.

Conflicts on integral plan making

I would like to highlight the target of house-building in the area of the IJsseldelta. This house-building project is one of the key targets of the bypass, and of large influence on it.

Figure 6 Dorp Reeve, in the south flows the bypass and in the north runs the Hanzelijn (railroad)

The development of houses near the bypass is described as an outstanding and attractive living area with innovative residential configurations in relation with water (Gemeente Kampen, 2013). The house development area is called Dorp Reeve. It will become an independent village for recreational living in a water rich environment. This village could be created because the bypass was designed as being passable by boat and has been put forward as a high-end residential area, with several inner dike and outer dike harbours, and a passable inland lake. This inland lake also has a water management function to create pressure on the seepage from the bypass.

> *"There is competition between city regions and some city regions are fighting hard to keep high educated people in the region. These effects are being felt in the Province of Overijssel. We have been very conscious of the importance of investing in quality to prevent this region from becoming a contracting region. On a regional level the decision has been made to create a high-end, water rich residential area linked to the bypass near the city of Kampen, as one of the elements to reinforce the settlement environment of this region."* (Provincie Overijssel)

Dorp Reeve has a direct link with the bypass and fulfils for a large part a regional housing demand and partially a local housing demand for the city of Kampen. The plans of real estate development for the city of Kampen date back to before the bypass. The city of Kampen had planned their housing demand and already bought strategic ground positions. These plans have changed with the development of the bypass.

> *"The city of Kampen already had real estate development plans for their own housing demands. Strategic grounds have been bought in cooperation with a consortium and these grounds were all located above the railroad, the Zwarte Dijk area. [...] The exchange solution [in the IJsseldelta-Zuid plan] designated a new location for real estate development. As a result, the strategic ground positions were not going to be used for real estate development for the city of Kampen."* (Gemeente Kampen)

The city of Kampen already had taken ground positions for their demands, but the plans of the bypass changed these ground positions to worthless, nothing happened with these grounds. The city of Kampen claimed their place in the bypass project for the development of real estate development.

> *"Zwolle has to develop top employment and we [the city of Kampen] built a top location where they could live. To say it in a simplistic way, as a quote, the negative migration rate has to be solved with that residential development area. An outstanding, water rich living environment. We see the drift towards water rich living environments, and water rich living in a* ***village*** *living environment is a golden opportunity."* (Gemeente Kampen)

The village environment together with a water rich living environment is what is making Dorp Reeve differential to other water rich environments, which are mostly located in a city environment (Gemeente Kampen, 2013).

In the beginning of the project, the financial outline of IJsseldelta-Zuid was dependent on the real estate development of Dorp Reeve. The profit from this area could be used to partly cover investments in this bypass. This principle has been abandoned, because of the financial dependency for this project; to be independent on the financial aspect, the provincial contribution has been raised (Provincie Overijssel).

The plan of inclusion of Dorp Reeve enlarged the whole integral plan of the IJsseldelta-Zuid. As Tauw explains:

> *"Quite early in the project, the city of Kampen has forced to participate in the development of the IJsseldelta-Zuid, as in the residential area they wanted to develop and to do the development plan for this residential area as well. This attitude has formed the projects procedure and processes to its current state, otherwise it, [the bypass], could have been developed as a National Integration Plan."* (Tauw)

To be more specific about the role of Kampen in the IJsseldelta-Zuid project, I want to phrase a quote of the municipality of Kampen, where it becomes clear how different positions have been taken in the development of Dorp Reeve.

> *"The city of Kampen wanted initially to develop on the north side of the Hanzelijn and we had taken strategic ground positions. But the province decided differently. If the city of Kampen wanted to develop according their original plan, the province did not facilitate in their development plans; it was only possible by drawing a very thin arrow towards this area, but we will facilitate in real estate development on this [current location of Dorp Reeve] location.* (Gemeente Kampen)

The implementation of real estate development in the integral plan was a possibility for the municipality of Kampen to develop beyond the N50. This position in development of the current Dorp Reeve has been taken from the Zwolle-Kampen-Netwerkstad (ZKN), where Kampen took the responsibility to develop this location on behalf of the need of real estate from a regional perspective. Kampen had to develop 1100 houses for the housing demands of the city of Zwolle and 200 houses for own demands resulting in the development of 1300 houses in Dorp Reeve.

The financial independency has been an appropriate path to take. The development of Dorp Reeve is now frozen, because the housing demand for the municipality of Kampen has not been proven for Dorp Reeve.

The combination of different spatial elements

Dorp Reeve is going to be built in and alongside a large seepage pond. This pond has to collect and deliver pressure on the seepage from the bypass. In the south of this area is a dike located which is developed as a delta dike or climate dike. This means that this dike is built much higher in order to be able to link other functions to this dike. One of these functions is real estate; Dorp Reeve is partially built on the dike.

But this climate dike design was not intended in the first plans of the bypass. In the beginning the idea was to build islands in the bypass area, where houses could be built on. This idea has been rejected by the water board.

> *"The idea was to live, work and have leisure activities linked to water. Therefore, the dikes had not to be built higher than necessary. The idea was to build residential islands in the Reevediep area, the bypass. But these residential islands have to be save and we, as the water board, are not going to build and maintain mini-dike-rings. So it had to become mounts in the bypass area, which had to become 3,5 metres high, missing the link with water"* (Waterschap Groot Salland)

To make living, working and leisure activities possible with a link to water new ideas have been made and the result is the climate dike.

> *"For the perception of the bypass, it would be nice to build upon a dike, but this is only possible when this dike is robust for at least a hundred years, a so called climate dike. We also had a problem with the water balance in the area. The idea was to make an inner dike lake, which directly collects the seepage. This high dike could have a tiered decline towards the lake, where people on the inner side of the dike have a relation with water, where you could do leisure activities, cruise with a little boat, independent of the storm and discharge. Safety is guaranteed, so you could have a garden close to water. A sluice has to be built to enter and leave the lake towards the bypass. This simple solution, the egg of Columbus, did hit the nail on its head, where all developments come together like hydrology, water safety, and real estate development plus the environmental perception.* (Waterschap Groot Salland)

The climate dike is where different aspects of the integral plan come together. But it is not where spatial planning and water safety go hand in hand; spatial planning is not contributing to water safety. The climate dike is designed to fulfil other spatial functions besides flood protection. It does combine the targets form the integral plan, but it does not really contribute extra to water safety. Than a normal dike could have done the job as well.

Theoretical review

Pathway dependency

Looking back to the theory in order to reflect on water safety and spatial planning; the Room for the River programme is not using spatial planning in order to create water safety. The whole bypass could be seen as a spatial measure for water safety, but it still is a hard core water management intervention. The goal is to get a 41 cm water level decline at km 979 in the river IJssel and this is achieved with river bed deepening and the construction of a bypass. These interventions could be gathered under the header of measures from a water management perspective. The Room for the River programme allows improvement of spatial quality, but this does not improve the water safety aspect.

The question here is whether the high water channel or the spatial tasks is/are leading in the integral plan of the IJsseldelta-Zuid. Different organisations put their question marks whether water safety is really leading in the development of the IJsseldelta-Zuid. The spatial planning tasks in the region are of a large influence on the outlook of the high water channel. For instance, recreation and house-building had a different standpoint if the bypass was not permanently containing water, and thus making boat passage and living near water impossible. In *"the casus IJsseldelta-Zuid, local authorities used the interpretative flexibility (Heuvelhof et al., 2007) granted by central-level authorities to turn Room for the River from a Safety and Nature narrative into a Regional Development narrative which fit nicely with their own value system."* (Warner and van Buuren, 2011)

From a water safety perspective, the programme of Room for the River is leading. This programme has been set up to give more space to rivers, where the main target for this case was the river bed deepening. The designed trajectory for this riverbed deepening has changed due to new insights, mainly the possible threat to drink water winning in the area. Due to the changed insights, the bypass has been put on the agenda in order to fill the gap derived from the shortened river bed deepening.

Pathway dependency could be placed in the lights of water safety, spatial planning and hydrological system. All these systems are linked with each other and come together in the bypass system. The water safety aspect is being achieved with a riverbed deepening and the development of the bypass. Spatial planning is linked to the bypass with integral plan making. The whole integral plan is linking water safety and spatial planning. But the spatial aspects do not contribute to water safety. The hydrological system is based on a blue or green outlook of the bypass path development.

If you review on the preformation stage of pathway dependency on the IJsseldelta-Zuid case you could determine several structures which have stimulated, shaped and scoped new opportunities and intuitions:

- The area development of the city of Kampen before water safety was put on the agenda;
- The bypass option;
- The riverbed deepening option;
- The wishes from different governmental layers on spatial development: nature, recreation, house-building, improvement of the infrastructure, spatial adaptation of the Hanzelijn and strengthening of the agricultural sector.

These structures have been developed in the preformation phase of the integral plan making. From here on other structures have been added. But the creation of paths in the case of the IJsseldelta-Zuid made actors more eager and motivated to attempt to make their technologies and techniques the basis of a new path (based on Martin and Sunley, 2006). But all these paths in the integral plan made it more and more complicated and during the its course of pathway development the paths have changed significantly because of new insights.

To review the whole path dependency aspect for the IJsseldelta-Zuid case, it has to have a clear starting point. Frankly, it is hard to say where the starting point is. The province says they wanted a safe, easy and attractive passage for small boats between the IJsselmeer border lakes and the river IJssel. But if this was their starting point, why are there still dry and green versions for the bypass investigated; in this situation it is not passable by boat.

The pathway dependency has always been on a bypass related development. This path has been set out and during its course external forces changed the pathway. The development for the IJsseldelta-Zuid has been locked in an integral plan with multiple targets. Linking water safety with regional development. How water safety had to be achieved has changed during the course of plan making, but the integral plan making has always been focus point in the development of the IJsseldelta-Zuid.

Institutional change

Institutional change has a direct link with path dependency; the creation of paths made actors more eager and motivated about their technique or technology.

The Room for the River programme is the key programme on water safety in this area. Water safety is reached with riverbed deepening and a bypass. The explicit goal for this programme on safety was to reach a water level decline of 41 cm at km 979.

The integral plan making in the IJsseldelta-Zuid linked different targets to the water safety measures. The integral plan making is based on a regional level and promoted as a key project in development planning. The link of spatial targets to the water safety aspect made the whole plan more complex. *"Regional planning – which is also often typified by complexity and inherent uncertainty – also calls for knowledge and stories to be interwoven. In practise this means that there must be moments in the process where knowledge and stories come together"* (Hajer, 2010, p. 133). But the knowledge and stories in the case of the IJsseldelta-Zuid did not always come together. Especially on the storylines between water safety and spatial development. The link of these two fields have never come together in one broad supported story.

In order to have a successful institutionalization of the IJsseldelta-Zuid plan it has to become a broadly accepted plan. But the element of knowledge has blocked the plurality of the plan. *"The joint learning process fell apart after government partners engaged external experts on their own initiative in order to strengthen their own position."* (Hajer, 2010, p. 66) The strengthening of the own position by the use of experts made the process an advocacy planning process. This is inflicting the institutionalization of plans as explained by Healey, 2006, p. 307; *"…power needs to mobilize and build knowledge resources and relational resources (social networks) which not only help to consolidate power and legitimacy around the new arena but have the capacity to carry the new ideas, understandings and recognitions of opportunity and struggle through to a wide range of other arenas in the urban governance landscape where practices shape how resources flow and regulatory rules are exercised."*

Policy design

To review on the theory of policy design I want to rephrase the requirements for a successful policy design:

1. Policy aims, objectives and targets need to be coherent;
2. Implementation preferences, policy tools and tool calibration should be consistent;
3. Policy aims and implementation preferences; policy objectives and policy tools; and policy targets and tool calibration, should be congruent and convergent (Howlett, 2009, page 73)

If I review policy design on flood risk management in the IJsseldelta-Zuid, policy aims, objective and targets need to be coherent. The plan for the IJsseldelta-Zuid has six targets; nature, recreation, house-building, improvement of the infrastructure, spatial adaptation of the Hanzelijn and strengthening of the agricultural sector. This is all combined with the objective of water safety in the area and the policy aim was to create a safe, passable waterway between the IJsselmeer and the river IJssel. The coherency between the aims, objectives and targets is debated. The integral plan making as an instrument to develop the IJsseldelta-Zuid as a whole and create a water safe environment, results from the embedded relationship, from the framework of spatial quality in the Room for the River programme (based on Howlett, 2009).

4.3 The IJssel-Vechtdelta

The IJssel-Vechtdelta is the area where the rivers IJssel, Vecht and Sallandse Wetering meet. Climate change is changing the water aspect in this region, where it has to cope with more water discharged via rivers. This delta is also under influence of the IJsselmeer and the decisions of its water levels for fresh water supply for the dry periods.

The IJssel-Vechtdelta is considered as a high value area, but also vulnerable. Values lie within the social-economic aspects; growth region, cultural historic values, and environmental values; National Landschap, Natura2000 and the Ecologic Main Structure. The Delta Decisions of the delta programme come together in this area where the delta decisions of water safety, spatial adaptation and IJsselmeer area are of influence in particular. The changed water system in the area has direct consequences for existing spatial functions, living, working, the water system, agriculture, nature, regional economy and recreation/tourism, influencing the spatial planning of the IJssel-Vechtdelta on water safety (Provincie Overijssel and IJssel-Vechtdelta, 2012).

Tasks on the development of the area are investigated on the link between spatial planning and water safety; working towards a sustainable spatial outlook of the IJssel-Vechtdelta (Provincie Overijssel and IJssel-Vechtdelta, 2012). This is conceptualised with the multi-layer approach of water safety, linking the regional aspirations and targets, climate proof growth and spatial quality.

> *"A strategy has been developed on how we can establish this region sustainable, water safe and climate proof in which we have set measures from layer one, layer two and layer three from the multi-layer safety approach. We are the drain of the basin of the river Vecht, the Rhine basin and the IJsselmeer. It is judicious to take complementary measures. It is about looking cleverly at how the spatial dynamics in the area could be deployed to take complementary measures."* (Provincie Overijssel)

Policy on multi-layer safety

The policy on multi-layer safety is designed via different routes. In the case of the IJssel-Vechtdelta it is created via water safety, climate proof and robustness. Climate proof does also incorporate the climate proof city, where measures are taken against climate change, including measures on heavy rainfall, long term drought, and-or extreme heat (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014b). The distinction between the climate proof city, based on influences form the climate change, and water safety is not very hard, but the climate proof city implicates other measures; not on water safety but on water nuisance (Expertisenetwerk Waterveiligheid (ENW), 2012), plus drought and heat effects. Some measures could work on both domains, as well as climate proof city and water safety. For this thesis I focus on the water safety aspect and how policy is designed on making the region of the IJssel-Vechtdelta water safe against floods with measures from the multi-layer safety approach. The policy in the IJssel-Vechtdelta is been shaped with leading principles, which includes.

- Water safety and climate proof as the basis;
- Sustainable area development;
- Liveability and involvement and persistence by resilience (Provincie Overijssel and IJssel-Vechtdelta, 2012).

These principles are corner stone for the development of a robust, water safe and climate proof region. But it is not building alone upon these corner stones, the whole process is a transition towards accepted practices in flood risk management. The province of Overijssel explains:

> *"In itself is it a regional transition process you go through and interesting are the aspects which play a role herein, are also the aspects which boost this transition […] An important aspect is the impact [of projects] it could induce in organisations. […] Parties involved in these projects will seek discussion in their own organisation on what do we need to do with this. You want new routines to be developed, new ways of working within these organisations and that it will be secured in all of their plans and thinking."* (Provincie Overijssel)

This quote is explaining Healey, 2006, p. 304: *"…governance transformation could be identified where a new discursive frame appears and diffuses to a range of arenas with sufficient effect to shift significantly the way resources are allocated and regulatory tools are formulated and used."* The transformation in the IJssel-Vechtdelta is achieved by translating the developed routines on water safety, climate change into concrete projects. These new routines could be seen as the discursive frames of Healey, 2006. The range of arenas are the parties involved in the projects and willing to seek discussion on their own businesses related to the changed routines, resulting in new ways of working, secured in their businesses.

But according to the Province of Overijssel there also have to be prerequisites in order to have parties willing to change their routines. (Dovers and Hezri, 2010, page 213), state that new routines *"must become an organizing principle across policy sectors and acted upon in the near term, inviting a focus on how that can be achieved through public policy and administration."* In order to come to a new routine in flood risk management

> *"you need to have some prerequisites. There has to be a clear urgency in the area, there has almost to be a 'pain' [knowing what floods could do] in the area, and there has to be a problem. In this area we have these prerequisites. […] The identity of this area is determined by water. If you look at the history of this area, it is shaped by water. You have the Hanzesteden, the landscapes in which mounts are still present. So deliberately dealing with water is certainly extant. […] There also has to be awareness of dependence among involved parties. I cannot do it alone, I need my neighbour, my fellow-company, my fellow-government to get things done. This has to be gathered in a joint ambition, a joint direction on which you need to press for actively."* (Provincie Overijssel)

The way of acting upon a water safe, climate proof and robust region is not just a copy paste to every other region. As stated before there need to be prerequisites to get new routines in organisations but also parties which fulfil a certain role, where the role of the province is as followed:

> *"The awareness that water plays an important role in this area is present in this area and this helps a lot. We, as province, have made the decision to set up a programme in which we take the impetus function, in which we are aware and have the awareness of dependence. We have acted thereupon and took the responsibility that parties realise: 'we cannot work without each other and have to take steps [in order to develop this region on a water safe, climate proof and robust manner].' The funds on ambition have contributed to configure beyond these prerequisites. We have created a lot of prerequisites to make headway in this process. It is area specific, it based on the situation, and it is not just copy-paste to another area.*

The link of water safety and spatial planning is conceptualized with the creation of so called smart combinations. Smart combinations are a form of multi-layer safety. Within these smart combinations, the multi-layer safety measures from layer 2 and layer 3 are also investigated. This could be an alternative for the reinforcement of flood defences as the result of norm tightening or other reinforcement tasks (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014b).

> *"With the second layer in the context of the multi-layer safety approach, the discussion is about smart combinations. Can you take measures from the second layer to prevent a measure from the first layer? A concrete example, if I place a farm on a mount, I do not have to reinforce a certain dike. This type of research is also done in this region, but you will face a lot of questions. Technically is it already very complicated, not mentioning the aspect of support; the juridical aspects, tailoring in time, and maintenance. These are very complicated questions involved."* (Provincie Overijssel)

Another way to link water safety and spatial planning is on joining and coordinating (spatial) chances with dike reinforcement projects. Linking spatial tasks to dike reinforcement to develop it together; smart ways in reinforcing dike in combination with other functions and with the cooperation of public and private parties (Buuren et al., 2015). Smart combinations could be defined as compiled solutions or integral solutions (Buuren et al., 2015). With integral solutions it is necessary to integrate the images and agendas which result from different sectors and domains. It is essential to coordinate involved parties early in the process, to prevent frustration and missed opportunities.

"It is about linking spatial tasks to dike reinforcements; linking different spatial tasks together. The fine art therein is to make sure at the front of the process, when there is still room for change, that both tasks will be combined. We, as the province play an active role with the opportunity map, a map with possible combinations, to boost the process. If a dike reinforcement project is in the planning phase or realisation phase, it becomes hard to readjust it. You have to make the combination at the front of the process; linking dike reinforcement with spatial planning.

Making a (smart) combination, linking the domains of water management and spatial planning, needs to be done early in the process, to create synergy between the developments from both domains. At the front of the process it is more easily to make adjustments. The further in the process, the harder it can get.

The technical implication plays an important role, together with the governance of smart combination which implies the decision-making, responsibility deviation, finances and (legal) assurance (Buuren et al., 2015). I would like to highlight the aspect of finances, because the IJssel-Vechtdelta has searched for ways on financing measures in the multi-layer safety approach.

"If you look at the financial aspect, you have a process of change to go through. Many current structures are focussed on Room for the River and dike reinforcement. But what you see on climate proof arrangement and water-robust development, the financial aspect is still in its infancy. The financial system has to change. This could be achieved in many ways. […] Eventually, it is very important for the governments to decide on their way of acting and which role could they play in it.

The financial aspect of the multi-layer safety approach has many uncertainties, especially in the second and third layer, which are not based on the prevention of floods. Therefore, it is important to have a clear strategy in the changed system of water safety to work towards new ways of acting. It is important to have a clear strategy and define the role you are willing to take. The following portrayal describes how new ways of financing water safety are explored in order to work towards water safe environments.

If you look at an outer dike area in the IJssel-Vechtdelta, the Kampereilanden, we have, as government, decide not to finance the mount plan for this area. The role we took was to make parties aware of a holding perspective, wherein parties decide to (co-)invest or not; do I take the corporate risk of a flood? In this way you take a very concrete role and businesses decide themselves to make a choice in it. There are many more routes to take. We have a dialogue with financial institutions and banks to procure climate mortgages. If a company is climate proof arranged, it runs less risks, which means the resources are better protected, resulting in a mortgage with a different interest rate. This could be a financial encouragement for companies to take certain measures. There are many routes which could be explored to develop a new routine herein." (Provincie Overijssel)

From this portrayal it becomes clear that the province takes a clear role on water robust development in the area of the Kampereilanden. But other ways of financing are explored as well in order to work towards a new financial system on water safety.

To get more into detail, I have investigated two different cases in the IJssel-Vechtdelta; the city of Zwolle and the Kampereilanden. De city of Zwolle is used to see how spatial planning and water safety are used in a city environment and which measures are used to protect Zwolle. The case of the Kampereilanden is used to see how an outer dike area is protected against flooding.

Interchangeability of measures

The city of Zwolle is located at the lowest point of the dike ring; if a dike collapses, all the water will flow towards Zwolle. Also the inner-city of Zwolle is an outer dike area. These two statistics will influence the water safety policy of the city of Zwolle.

The city of Zwolle is also depending on the decisions made for the IJsselmeer. Delta decisions on the IJsselmeer could have a large influence on the water safety aspect of Zwolle. The IJsselmeer has a freshwater buffer of national concern, but this freshwater buffer could decline due to climate change, whilst the demand could increase (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). With the introduction of new and flexible water level management a structural freshwater buffer will

arise. A proposal has been set up for the IJsselmeer, where the rise of the water level is of most influence on the city of Zwolle, and the IJssel-Vechtdelta as a whole. The one metre water level rise will be replaced by a 10-30cm rise in the first place (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). But the long term situation for the IJsselmeer water levels is still unclear. The first step is this flexible water level management, but if the demand for fresh water rises, the buffer could rise to 40-50cm above the current water level (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). But even with a rapid climate change and a large demand, the fresh water supply could still be short. Investigations are done on: enlarging the water buffer further, at a low water level in the rivers discharging more water via the IJssel, or accepting the damage due to water shortage (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). All these measures could have profound implications. These changes in the policy on IJsselmeer water levels could have profound implications on the IJssel-Vechtdelta and actions have to be taken in order to make this region delta proof.

One of the features on delta proofing in the city of Zwolle is the sound barrier in the district of Stadshagen. This sound barrier is prepared as a barrage as well. It will not become a full-fledged dike, but could give the inhabitants extra time to evacuate from the area.

> *"The sound barrier of Stadshagen is prepared to be a dike, but we call it a consequence reductive measure. We do not call it a dike, because it is no dike. Here you are exactly in the domain of what is adaptive, what is consequence reductive and what is prevention? What is layer one and what is layer two; something we also face here."* (Municipality of Zwolle)

The exact definition of layer one or layer two of the multi-layer safety approach is not the only difficulty faced by the municipality of Zwolle. The exchangeability of measures between these layers is one of the key concepts on multi-layer safety in the municipality of Zwolle. The exchangeability of solutions does also bring forward the difficulty on the implementation of exchanging measures.

> *"Measures [on flood management in the municipality of Zwolle] are inserted from how layer one and layer two can be exchanged."* (Gemeente Zwolle)

The water safety norms have to be achieved with measures from the first layer. However, measures from the other layers could include safety besides the safety from the first layer. The municipality of Zwolle wants to explore if it is feasible to exchange measures from layer 1 and 2. In the long term they want to innovate in the governance of water safety where the role of measures from layer 2 and three will play a larger role to prevent future dike rise (Gemeente Zwolle, 2015). But the municipality also calls into question innovative governance approach because it has all sorts of details and complications which have to be sorted out.

> *Zwolle is located is dike ring 53, which starts at the city of Deventer, and Zwolle lies at the lowest point in this dike ring. If the dike breaches at Deventer or further north, all the water will flow towards Zwolle. So we were thinking; can we make a compartment in dike ring 53. If you assume to build a new dike it is not possible, but if you start form the already existing heights, the possibilities are much larger, because it costs less money. What could a water barring landscape bring? Do you have to do less on your other dikes if you develop this water barring landscape and could you exchange the financial aspects? But in reality it is proven to be very difficult; it will not happen."* (Gemeente Zwolle)

The long term goal of multi-layer safety is causing difficulties on the exchange of measures and finances. "*Time is determining the measures to take"* (Provincie Overijssel). The phase on water management is transitional; from a dike reinforcement and river widening phase, towards clever linking other flood management measures from a spatial planning point of view.

> *"The advantage you could achieve with spatial planning, is not directly linkable to lowering the task on dike heights. Nevertheless, if you take water robustness into account for a period of 20-30 years, the norm of your dikes could stay on the same level. The only reason dikes will be revalued on their safety, is because we have done nothing with spatial planning for 30-40 years. The number of victims was increasing, we were building more assets behind the dikes, and the water levels are rising. The reassessment of norms, required the dikes to be reinforced; and within thirty years we will have the same discussion. If you take into account spatial planning and water safety*

structurally, you will be able to prevent a higher norm in the long run. That is the relation you are aiming for. Financially it is difficult, because who is going to pay my adjustments in spatial planning now, which will be paid back in the long run because the norm is not heightened. The relation is very explicit, but the financial practise is not ready for it." (Provincie Overijssel)

This quote shows the difficulty of the transition in water management. The spatial planning domain has fulfilled an insignificant role in water safety for many years. The insignificant role has let to institutional paths of increasing return effects, the control paradox on floods with reinforced dikes (Remmelzwaal and Vroon, 2000), new safety norms results reinforced dikes. If spatial planning is implemented in the water safety task, it could break through the control paradox on floods by dike reinforcements, through looking at other options of creating water safety.

Spatial planning on reducing the risks of a flood

The Kampereilanden are part of the IJssel-Vechtdelta which has been under influence of the river IJssel and the Zuiderzee. From the 15th century, farmers in the area protected themselves by building their barnyard on mounts, to stay dry during floods. This way of building has led to a characteristic area with compact and planted barnyards high on mounts scattered through the area (Paridon and Groot, 2015). The Afsluitdijk made the threat from water disappear and the necessity to build on mount. New barnyards and enlargement of existing barnyards were built on ground level.

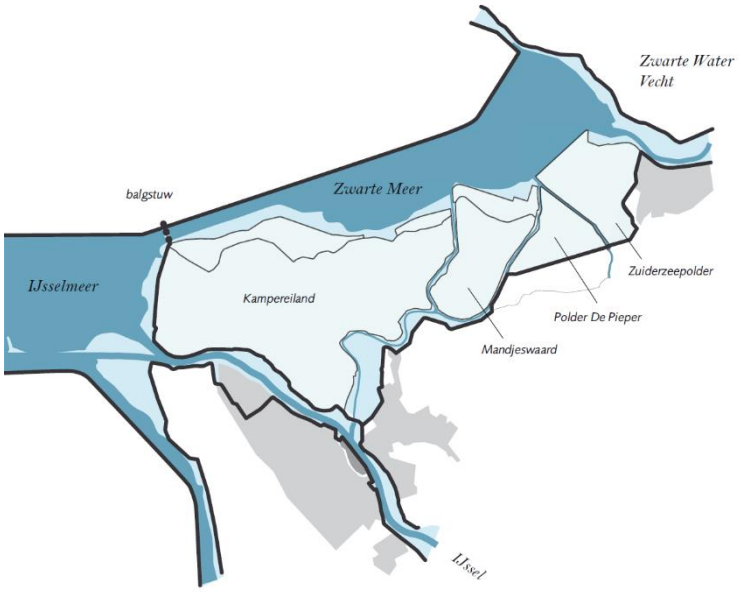


Figure 7 Overview of the Kampereilanden and its surrounding waters (Paridon and Groot, 2015, page 6)

The polders of the Kampereilanden are outer dike areas, located outside the primary barrier; the Kamperzeedijk. From different sides, water comes towards this area; the IJssel, the Zwarte Water, and the IJsselmeer. In extreme situations, the water could threat the area from all sides and push it up to extreme heights. The cities of Kampen and Zwolle, are prioritised on staying dry (Paridon and Groot, 2015). The area is protected by a regional barrier, with a safety norm of 1/500.

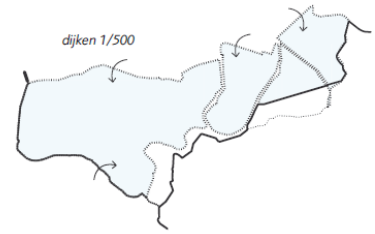
The Kampereilanden are appointed as a water retention area. This means that the primary flood defences will flood prior to the primary flood defence elsewhere in the IJssel-Vechtdelta (Kolen et al., 2013). Changes in the safety norms of the Kampereilanden could have consequences for the water safety aspect elsewhere in the region. The status of water retention area could be seen as a legitimisation to effort on measures limiting the consequences of a flood in the area (Kolen et al., 2013). The water safety concept could provide new opportunities to enlarge the water safety aspect in this area.

The pilot of the Kampereilanden has been set up to provide information on the realisation of custom solutions for their company, conform the character of their barnyard, and their company, and within the investments they want to do in the coming years (Paridon and Groot, 2015).

Absolute safety does not exist for the Kampereilanden, but multi-layer safety could provide a package of measures to work towards an acceptable risk and costs on the one hand. On the other hand, the additional measures everyone could take voluntarily to add to this risk level. The level of toleration and acceptable measures is a political or social question (Kolen et al., 2013).

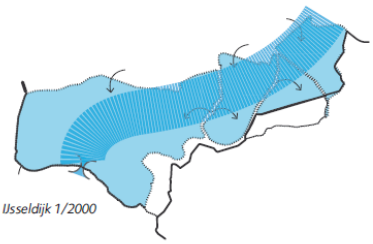
The plan to work on a floodable Kampereilanden is a very complex situation. How do you work on the prevention of a flood? How do you keep the consequences of a flood as low as possible? And how to you ensure the area is unflooded as quick as possible? These question should be asked on the individual level and on a regional level.

> *"How can you prepare the region against flooding and what can you do yourself? […] Which measures can you take? This could be pure technically approached, but it has been approached from the qualities of the area. How can you take measures with these qualities in mind? […] There are still old creeks in the area which could be used to unflood the area. Pumping stations would take too long, but this old creek system and the discharge sluices could accelerate the unflooding of the area. But an application like this means that the water has to towards these creeks, you have to take into account the water system itself; is it large enough or should it be made larger, to reduce the consequences of a flood. [..] The mounts itself is also a complex system. The main questions asked here are; what is the current situation? What do I have to do? And what is the end result? That is something we have to get grip on. [..] Another issue is the situation when flooded and you are safe on your mount, what do you do with provision of your company; fodder, milk, etc. In the end you want to come on stream again and be accessible again. You want have emergency routes or quick recovery, regardless the flooding. You could raise the road network, but this could create compartments in the area."* (Municipality of Kampen)



Situatie 1: Gecontroleerde overstroming (kans 1:500) leidt tot enkele decimeters water in één of meer polders van de Kampereilanden.

Situatie 2: Langdurig hoogwater of een dijkdoorbraak op één van de Kampereilanden (kans 1:500) leidt tot een maximale waterhoogte van 1.50m boven NAP.



Situatie 3: Een doorbraak van de primaire waterkering tijdens hoogwater (kans 1:2000) leidt tot rampzalige waterhoogten op alle eilanden. Dit is niet meegenomen in de rapportage

Figure 8 Flood scenarios and water depth (Paridon and Groot, 2015, page 9)

These are only a few aspects of working towards a mount system in the area of the Kampereilanden. All three layers of the multi-layer aspect come together in this case.

> *"The situation could be seen as; layer one is to have your dikes in order and comply with the strongest demands. But with only layer one you are not safe; a dike could breach of flood. You have to evacuate, layer three, crisis control. But there is a layer in between; what could you do yourself to prevent ending up in a crisis situation? And when it happens; how could you prevent possible damage? This is the general system of multi-layer safety."* (Municipality of Kampen)

The situation of the Kampereilanden is based on a regional system and an individual system of protection.

> *"Layer one has to be up to date; the regional barrier in the area. After this it is up to the second and third layer; the primary defence of the area is done. The following step is what you can do yourself as inhabitant or company; making your own choices measures to take. We have handed down a toolbox for measures which could be taken. You could do this and if you operate within these boundaries, you will get planning support. [..] You are forced to do something with water safety. The procedure for authorisation will be used to investigate water safety.* (Municipality of Kampen)

Financing these measures is set for the long term period, but strategic choices have to be made at this moment. And these strategic choices are bounded to financing and interest rates.

> *"You have to work towards the situation where your whole barnyard is located on a mount. This means an advisor has to sit around the table with this framer; this is my vision for the long term and these are my problems for the short term. Within the coming 20-30 years I want to have the whole mount on the right height. In this way is the debit item is much smaller, then the case when you do everything at once. But you need a development strategy on yard level."* (Municipality of Kampen)

> *"The Kampereilanden are located in a water retention area with a low water safety value. The banks ask a higher interest, than elsewhere. A large part of the Kampereilanden, about 80 percent, is leased. [The financial situation] has changed. Early the Rabobank was a cooperative bank with a local management and financing was pretty easy; local people had to decide. A farmer from the Kamperzeedijk, who has been in the management of the local Rabobank, said the approach was based on overall thrust; we carry the risk together, we will not hamper businesses. There is a risk, but we shoulder the risk together. This shouldering of the risk together has been disappeared at the Rabobank. At other banks as well, because of scaling up. [Financing water proof building has an uncertain risk] and what does this mean for a bank or insurance company."* (Municipality of Kampen)

In this case as well, the financial structures are still uncertain, but new ways of financing water safety are investigated. Especially on an individual case. The situation of the Kampereilanden makes individual water safety necessary because of the limited amount of reaction time on floods and the water retention function it has to fulfil. The multi-layer safety approach in the Kampereilanden will give farmers opportunities to work on their own responsibilities. It *"…must become an organizing principle across policy sectors and acted upon in the near term, inviting a focus on how that can be achieved through public policy and administration."* (Dovers and Hezri, 2010, page 213)

Theoretical review

The case of the IJssel-Vechtdelta has shown how the policy on water management with the multi-layer safety approach could be implemented. It is still under development, but this case has shown that, with a couple of boundaries to take, how multi-layer safety could be implemented and how to work towards an accepted practise. *"New concepts have to challenge and shift an array of already routinized governance processes, with their complex mixture of conscious and taken-for-granted modes of practice. New concepts have to 'jump' boundaries and 'break through' resistances, involving implicit and explicit struggles."* (Healey, 2006, page 305)

Pathway dependency

The view on path dependency in flood risk management for the case of the IJssel-Vechtdelta could be seen as a perspective on **dynamic increasing returns** where *"...the argument that the development of many phenomena is driven by a process of increasing returns, in which various externalities and learning mechanisms operate to produce positive feedback effects, thereby reinforcing existing development paths"* (Martin and Sunley, 2006, page 400). The process of increasing returns is water, the area of the IJssel-Vechtdelta is shaped by water and certain prerequisites are related to water; *"urgency and pain"* (Provincie Overijssel). These prerequisites have reinforced path development on flood risk management. The existing path of dike reinforcement and river widening, the case of the IJsseldelta-Zuid; the path of Room for the River, has been reinforced with the use of the multi-layer safety approach, widening the scope of flood risk management. The mount landscape and old creek system in the Kampereilanden are investigated on how these old systems could work for the water problems of today. *"It is a transition against the odds and routines of organisations, but the aspects which play a role in this transition [learning mechanisms and positive feedback effects], which could boost the transition."* (Provincie Overijssel)

The creation of paths in flood risk management is a threefold of strategic purpose and deliberate action together with the motivation of actors implementing technologies and techniques (Martin and Sunley, 2006). The use of flood risk management is based on regional approach, where the path on flood risk management should fit within the outlook of the region. This system is also recognised by the Province of Overijssel:

> *"The choice has been made to set up a programme in which we are giving impetus [to a new path], wherein there is a recognition of dependency; to take the responsibility that parties realised they cannot operate without each other and we have to take steps forwards. There are many prerequisites which we have created to boost this process, but it is area specific, it is situational."*

This shows the deliberate action together on the implementation of technologies and techniques; in this case action on the water safety in the area via the implementation of multi-layer safety. *"...path dependence is not necessarily an alternative to purposeful strategic action but may actually make actors more eager and motivated to attempt to make their technologies and techniques the basis of a new path or to make their region or locality the home of a new industry* (David and Puffert, 2000 cited from Martin and Sunley, 2006). The motivated attempt has made the IJssel-Vechtdelta as one of the testing grounds of multi-layer safety where the 'delta proof' delta has resulted in the linkage between water and space via a development programme. It has been put on the agenda, and has given rise to areal knowledge, collective conscience and a place on the political agenda (Buuren et al., 2015).

There is a significant role *"to the importance of strategic agency and deliberate mindful deviation of entrepreneurs [who] mobilize recourses, ideas, and people in the collective creation of new technological fields* (Garud and Karnøe, 2001) cited from (Martin and Sunley, 2006, page 426). This role has the Province of Overijssel taken in the transition of flood risk management.

> *"The role changes and is based on a situation, but what you try is develop as much ownership as possible and ensure it at other parties. You are able, as a province, to take other steps, or take another role. Certainly when the new routine is there and secured in the (business) plans. You could focus on other processes. You preform your legal duties again, so to speak. Certain tasks do we have according to the dossier [of the IJssel-Vechtdelta], but you will not drive the processes anymore. You have to make sure the ball starts rolling and routine will be implemented."* (Provincie Overijssel)

The role of the Province is to develop the path on flood risk management, but when this path becomes locked-in, when the multi-layer safety approach is the routine, it enters a stable equilibrium (David, 2001, page 26-27). Sequential phases could be positive or negative on the path development (Martin and Sunley, 2006, page 418). The elaboration on the financial aspect of multi-layer safety could be regarded as one of those sequential phases which could bring the path dependency into positive or negative path, when succeeding or failing.

Institutional change

The concept of multi-layer safety is changing the game of water safety; the rules or institutions have changed. Probably the setup of the team has to be changed as well in order to model the creation, evolving and consequence of rules. *"The purpose for the rules [the institutions] is to define the way the game is played. But the objective of the team [the organization] within that set of rules is to win the game – by a combination of skills, strategy, and coordination. Modelling the strategies and the skills of the team as it develops is a separate process from modelling the creation, evolution, and consequences of the rules.* (North, 1990, page 4-5, cited from {Moroni, 2010 #109, page 277).

In this case the use of the multi-layer safety approach is implemented by selecting the right persons from different organisation involved in the game of flood risk management. The concept of multi-layer safety has to go *from the level of conscious actor invention and mobilization to that of routinization as accepted practices, and beyond that to broadly accepted cultural norms and values."* (Healey, 2006, page 304).

> *"Persons within organisations are a very decisive factor, because not everybody is the same in that organisation. You are depending on the people, from the governance theory the in-between-persons, who make a link between their own organisation and such a process or programme and who take that role in the organisation to gradually chance. I am trying to get those people aboard, who could fulfil this bridging [function]. But you need the prerequisites of urgency and awareness of dependency, otherwise you will fail. […] A lot of organisations go back to their own dossiers [routines], but you need those outcasts, those in-between-persons, to lay out a basis and boost the transition within their own organisation."* (Provincie Overijssel)

This quote explains how certain persons within an organisation could implement a new concept as new and accepted practise, where the *"institutionalization of a new territorial collective actor […] needs to mobilize and build knowledge resources and relational resources which not only help to consolidate power and legitimacy around the new arena but have the capacity to carry the new ideas, understandings and recognitions of opportunity and struggle through to a wide range of other arenas in the urban governance landscape where practices shape how resources flow and regulatory rules are exercised"* (Healey, 2006, page 307). This territorial collective actor could be seen as an entrepreneur. The disequilibrium of the new arena of flood risk management, the multi-layer safety approach, has to land as an accepted practise in creating water safe environments. The entrepreneur translates this disequilibrium, a phase where policies preformed, towards a stable equilibrium where the policy becomes institutionalised as an accepted practise, a lock-in. Institutionalisation of the multi-layer safety approach is depending on entrepreneurship, because it exists of *new ideas, understandings and recognitions of opportunity*, but it could offer new ways of dealing with flood risks.

But there are still boundaries to jump. In this case the financial aspect of multi-layer safety; long term profits, short term investments. But also the exchangeability of measures from different layers. In the case of the City of Zwolle it became clear that a measure from the second layer of the multi-layer safety is not a one-on-one exchange with the first layer. It is hard to calculate how a measure from the second layer is contributing to the prevention of a flood, and therefore could not be exchanged with measures from the first layer.

But these boundaries to jump do not result in a sit and wait attitude.

> *"It is a process [developing water safety with dike reinforcement] and in certain areas in the Netherlands, it is not suited anymore. The sea levels are rising, Schiphol continuous to descend. At a certain moment you will get into trouble. […] You can complain, but you can also act."* (Provincie Overijssel)

The rules of the game have changed and new methods are formed to play the game with these changed rules, the institutional change on flood risk management. But not only have the rules changed, the playing field as well; new insights have shown that new methods in flood risk management are needed in order to keep the field playable. You have to play with changed rules on a changed field; reinventing the game of flood risk management.

5. Comparison of the cases

In order to make a comparison between the different cases, I look at the different building blocks of flood risk management. Compiling these blocks will lead to a process or system of water safety. The contribution of spatial planning in the reduction of flood risks is investigated in the water safety domain. Especially, in the domain of flood risk management. This chapter provides a comparison of the different cases based on the spatial planning measures and tools used in the three cases. This comparison reflects upon the theories used.

5.1 Spatial planning use

The three cases investigated provided insight in the use of spatial planning in flood risk management. Spatial planning can be used as adding spatial quality next to water safety measures from the water management domain for example in the Room for the River programme. Spatial planning is not used to reduce the risk of a flood, but spatial planning is used to improve the spatial quality next to the water safety measures from the water management domain. Another way to use spatial planning is in reducing the consequences of floods where spatial planning is not preventing a flood, but is ensuring the consequences of a flood will be as low as possible. This usage of spatial planning measures is shown with the case of the IJssel-Vechtdelta. Reducing the consequences of a flood is the designated role of spatial planning in the multi-layer safety approach (Schultz van Haegen and Wieriks, 2015). Furthermore, this research has shown that in the case of the Willem-Alexanderhaven with the use of smart combinations, measures from the spatial planning domain are used on the prevention of floods together with the improvement of the spatial quality. With the development of this area, preconditions have been set on the protection of this area against floods. A normal dike did not suite these preconditions, so other options have been investigated where spatial planning measures have been used to make smart combinations with the development of the area to prevent floods from happening there. The prevention of floods with the use of spatial planning measures is also investigated in the city of Zwolle where spatial planning is used next to the primary flood defence system. Spatial planning is used to prevent flood from striking in this area when the primary flood defence system fails, by filling the gaps between the natural heights in the landscape.

The usage of spatial planning in water safety is diverse. In the following paragraphs I will reflect upon the cases with the theories used in this research.

5.2 Path dependency

Path dependent processes in water safety are shaped by the water safety programmes. These programmes also shape the involvement of spatial planning measures and tools. The path dependency theory has provided insight in the development of paths in flood risk management. The programmes have certain prerequisites which have to be complied in order to realise the goals on water safety perspective. Stimulus to develop from these programmes are the funds provided in these programmes. Because the cases investigated develop water safety from different programmes, the role of spatial planning is also different. In two cases, the Maasvallei and the IJsseldelta-Zuid, the programme on water safety largely set the path for development.

In the case of the IJsseldelta-Zuid, the Room for the River programme has set the path for development on water safety, and allowed spatial planning as in the improvement of spatial quality. The improvement of spatial quality consists of spatial planning elements, but improving spatial quality does not contribute to water safety. This case has shown that a link between spatial planning and water safety can be established, but that the spatial planning domain does not contribute to water safety next to the water management measures.

The Willem-Alexanderhaven in the case of the Maasvallei has shown that spatial planning can be used as risk reductive measure and adding spatial quality in the same time. The strategies developed for Jazz-city have linked risk reduction and spatial quality by the use of spatial planning measures in flood risk management. But this case has also shown that combining spatial development and flood risk management measures do not always match. The development path has been set on the development from the Flood Protection Programme. The harbour area is protected by a sheet pilling wall, which is developed within this programme and which had to comply with restrictions of the programme; sober and practical. The path of water safety, did not act in accordance with the path of the Jazz-City project with a different development perspective.

The case of the IJssel-Vechtdelta has provided insight in the use of spatial planning measures and tools to reduce risk in flood risk management. Spatial planning has been used in a number of options to reduce the risks of flood. This variety of options has shown the possibilities of spatial planning in flood risk management. The linkage between the domain of spatial planning and water safety is approached from a different angle than in the case of the IJsseldelta-Zuid. Here the linkage between the two domains was found to be based on smart combinations. The emphasis is on cost effective and water robust development in combination with spatial planning or spatial development (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken, 2014a). The water management domain is linked to the spatial planning domain by taking into account water robust development. It is thus based on a link of water management to the domain of spatial planning, where the spatial planning domain is leading and water safety issues are taken into account.

The theory of path dependency has also shown that if a process is intercepted by new paths, the arrangement of these paths could become very complicated because the paths have to be in the same phase. If these paths are not in the same phase of path dependency, one path development has to be slowed down, or being delayed. The case of the Maasvallei has shown that slowing down the path of spatial development was complicated, neigh impossible, to implement because of the policy perspective on spatial development. The plan of the Willem-Alexanderhaven was bounded to the investments of real-estate developers and the legal embedding in development plans. Opportunities for developing inventive water safety strategies were there, but not in the same phase as the real estate development plans and thus not implemented. The implementation of inventive water safety was slowing down spatial development. Another strategy could be to speed up the new path, but it could result in precipitate decisions. This was shown by the IJsseldelta-Zuid. The deadlines of the Room for the River programme where of influence on the different subprojects. To deliver a complete integral plan, all initial subprojects according the development targets have been included. Some of these subprojects are excluded now, because these subprojects are not substantiated well enough and a threat for the integral plan as a whole.

In sum, spatial planning measures in the context of flood risk management are primarily used as risk reductive measures while adding quality is an added benefit, but paths of development from different domains have to be combined as soon as possible in the process to acknowledge a deliberate interdependency between the domains and to have a foundation for smart combinations on measures from these domains.

5.3 Institutional change

Institutional change was hindered by multiple barriers. The case of the IJsseldelta-Zuid has shown that a vague description of spatial quality in the Room for the River programme has resulted in a large integral plan where water safety and spatial planning are combined. The description of spatial quality was interpreted as a broad framework which was vaguely described and allowed actors to implement spatial development of the area under the header of improvement of the spatial quality. Barriers in the institution arose, because certain spatial elements in the integral plan where not correctly justified. The result was that these elements had to be removed from the integral plan in order to reduce the risks of the implementation of the integral plan. The institutional change on the role of spatial planning as adding spatial quality next to water safety resulted in a system where not only water safety was at stake, but the regional improvement as well where this regional improvement is used more extensively than intended, because the money was made available by the national government and an invitation to lay all wishes on the table.

The case of the Maasvallei shows clear evidence for barriers on spatial development in or near the riverbed because of hard regulations from the National Policy for Large Rivers. The different actors look at each other on how to comply to these regulations. Different opinions about the barriers of these regulated areas exist and is frustrating spatial development in the area. There is a disequilibrium of regulations and this disequilibrium has to be transformed in to an equilibrium set of regulations. The organisations have to define a way to work with these regulations on spatial development. The regulations have to become institutionalised and this requires a collective actor which has the power to mobilize and build knowledge resources for the institutionalization and success of new policy concepts. But knowledge gaps block the institutionalization of the multi-layer safety concept and thus no paths for development within the concept of multi-layer safety are designed and policy design is not possible because the policy formulation of the multi-layer safety concept is lacking.

Institutional change is needed, because of new insights in the system of flood risk management. The current strategy on flood risk management does not offer the right set of tools to meet its objective. This has resulted in some knowledge gaps which results in certain uncertainties and resistance on the institutionalization of the multi-layer safety concept. The IJsseldelta-Zuid has shown that even with certain uncertainties, the multi-layer safety concept can be implemented if entrepreneurs are willing to invest their knowledge to fill these knowledge gaps. The case of the IJsseldelta-Zuid acknowledges that *"new concepts have to 'jump' boundaries and 'break through' resistances, involving implicit and explicit struggles"* (Healey, 2006, page 305). But sitting and wait for others to break through these boundaries is not an option. Otherwise you keep lagging behind the institutional changes. This case has looked for options from a regional perspective to fill the knowledge gaps existing and have trust in the system that these knowledge gaps become clear in the long run. The multi-layer safety concept *"must become an organizing principle across policy sectors and acted upon in the near term, inviting a focus on how that can be achieved through public policy and administration."* (Dovers and Hezri, 2010, page 213). This could be seen as working towards a clear path, which is a trajectory in which an institution develops, through political and technical actions in the context of flood risk management; adapting towards a new way of operation on how flood risks in can be prevented and the consequences can be kept as low as possible.

"We are extremely spoiled in the Netherlands as it concerns water safety. We have dikes and nobody is concerned dikes could breach. This does not take away that on the long term it is important to take into account water changes and water safety in spatial planning. Frankly, the Netherlands is not very good at this, we are not used to it. Counteracting into the convictions and routines of organisations to get it achieved." (Provincie Overijssel)

From this it becomes clear that institutional change is highly context dependent and that the amount of the barriers is partly due to the contestation of unclear paths for development and missing entrepreneurship. Moreover, the rigidity of existing institutions and the amount of active policy entrepreneurs shows that institutionalization can take place with the right attitude. An interesting similarity across the three cases was that the role of an entrepreneur is key in the institutional change.

5.4 Policy design

Policy design could be reviewed from two levels. First the design of policy programmes and concepts from the national level. The Room for the River programme is a programme with coherent policy goals and a consistent set of policy instruments to give more room to the river in order to prevent what happened in 1993 and 1995; dangerously high water levels. The multi-layer safety concept has built further on this set of instruments with the implementation of new policy domains, spatial planning and disaster management in addition to reduce the risks of floods. This new governance arrangement is *"intended to combine policy instrument and their settings in new ways, so that multiple instruments support, rather than undermine one another in the pursuit of policy goals. [These arrangements] also attempt to integrate existing and sometimes competing, policy initiatives into a cohesive strategy; to coordinate the activities of multiple agencies and actors"* (Stead et al., 2004, Briassoulis, 2004) cited from Howlett and Rayner, 2007, page 7). The use of multiple instruments is conceptualised as smart combinations; the exchange and interchange between the three layers of the multi-layer safety concept of prevention, spatial planning and crisis management (Ellen and Buuren, 2014). A package of measures from these layers attempt to integrate different policy initiatives by linking the different domains in the multi-layer safety concept, into a cohesive strategy.

Second, policy design could also be reviewed from the implementation of the policy programmes and concepts on a regional level. *"Policy design involves the deliberate and conscious attempt to define policy goals and connect them to instruments or tools expected to realise those objectives"* (Howlett et al., 2015, page 291). *"Policy design is all about the effort to match goals and instruments both within and across areas"* (Howlett, 2009, page 73). The role of an entrepreneur is very important in the design of policy on flood risk management. Political entrepreneurs are the *"advocates for proposals or for the prominence of ideas"* and emphasizes that *"their defining characteristic is their willingness to invest their resources – time, energy, reputation, and sometimes money, in the hope of a future return"* (Kingdon, 2002, page 122). The objectives must be incorporated in a set of specific targets or measures which allow policy resources to be directed toward goal achievement (Howlett, 2009). This altogether can affect the current path and can be deliberately effectuated by policy entrepreneurs to direct institutional change onto their desired path. Policy

design, thus, has a direct link with path dependency and institutional change. This conclusion can be drawn from the cases investigated, where the cases of the IJsseldelta-Zuid and the IJssel-Vechtdelta have shown the role of an entrepreneur on the design of policy goals and the instruments and tools to realise those objectives in flood risk management. The Maasvallei is missing entrepreneurship and thus lacking the combination instruments and their settings in new ways of flood risk management.

6 Discussion

The objective of this study was as follows:

> To explore the link between water management and spatial planning. The importance of a link between space (spatial planning) and water (management) is emergent were "*disaster risk reduction, water resources' management and climate adaptation should no longer be treated as separate topics"* (Schultz van Haegen and Wieriks, 2015) and as the risk based approach is considered from the consequences of a flood as well (Zandvoort and van der Vlist, 2014). A broader focus on prevention, mitigation, preparedness and vulnerability reduction is needed (Schultz van Haegen and Wieriks, 2015). The changed institution on flood risk management asks for a different approach by the organizations working within the domain of flood risk management.

This study has tried to work towards its objective, and this chapter reflects upon the central aspects in this research. These central aspects are spatial planning, flood risk management and the multi-layer safety approach, together with the theories used in this research. Other aspects in this chapter are the influence of the researcher, the theoretical concept and possible additional research to this study.

As stated in the objective of this research, the risk based approach of flood risk management needs a broader focus on the prevention, mitigation, preparedness and vulnerability reduction. A broader focus in flood risk management has been introduced with the programme Room for the River, where the accommodation of water was added as a new discourse alongside the discourse of the battle against water (Wiering and Immink, 2006). The accommodation of water established a closer link to the domains of water management and spatial planning and developed a broader focus on the prevention and mitigation towards floods.

The policy on floods from the prevention and mitigation has been enlarged with the addition of preparedness and vulnerability reduction. This broader focus has shifted the policy on floods where the prevention of floods remains cornerstone of the flood risk approach, with the addition of spatial planning and crisis management, the multi-layer safety concept (Schultz van Haegen and Wieriks, 2015). The policy of flood risk management has been enlarged because the current strategy on flood risk management was no longer able to meet its objective (Deltares, 2010). Alternative strategies are needed to anticipate on climate change and socio-economic developments. These alternative strategies change the institution of flood risk management. A changed institution with new instruments to meet its objective asks for adaptation to make use of spatial planning and evacuation strategies to reduce the risks of a flood. Adapting towards an approach on flood risks where not only the prevention of flood is taken into account, but the consequences as well. But adaptability can be limited by the following constraints according IPCC, 2007 page 56 as:

> *"…financial, technological, cognitive, behavioural, political, social, institutional and cultural constraints limit both the implementation and effectiveness of adaptation measures"* (Dovers and Hezri, 2010).

To adapt to changed institutions, organisations need to adapt their policies. But as stated constraints could limit the implementation and effectiveness. In this research some of these barriers have been named in the cases investigated. *"Institutional and cognitive barriers are where attitudes to risk and understanding of climate change and its implications affect prospects for adaptation. This is influenced by factors such as local context, other near term priorities and institutional settings defining the flow and credibility of information"* (Dovers and Hezri, 2010, page 219). This research has shown that institutional change is effected by barriers which are of influence on the institutionalization of the multi-layer safety approach. Barriers need to be overcome in order to adapt, which includes policymakers to be aware of these barriers.

The institutionalization of changed institutions is based on knowledge (Healey, 2006, page 307). But this research has shown there are some knowledge gaps or barriers. These knowledge gaps bring forward uncertainties and these uncertainties make policymakers to go back to a proven strategy. Institutional settings of the multi-layer safety concept are not clear, because it is not clear how measures from the layer of spatial planning and the layer of evacuation strategies can contribute to meet the safety standard, for instance. There is no incentive to invest in measures from these layers, because the safety standards are set

for the primary flood defences, the first layer of the multi-layer safety (Schultz van Haegen and Wieriks, 2015). As Dovers and Herzi, 2010 state:

> "*There is little attention to the mechanisms of policy and institutional change, to structures and processes within public policy and administrative systems at national and sub-national (state, provincial, local) jurisdictional scales – the means to the ends of adaptation." (p. 219)*

The barriers on institutionalization have to be solved in order to work towards institutional paths. New paths could be created in situations when actors within the process are able to access, understand, and convert knowledge, into new path or renew older ones (Martin and Simmie, 2008). Path creation could be limited because these conditions are not obtained. Policy design is based (1)policy formulation and (2)policy tools and instruments (Howlett et al., 2015). The basis for flood risk management is the prevention of floods and is rooted in the measures from the first layer of the multi-layer safety approach. The policy formulation is unclear and not the whole range of tools and instruments formulated do contribute to meet the safety standards. This strategy could miss its broader focus on prevention, mitigation, preparedness and vulnerability reduction, because the full range of instruments is not being used in the reducing the risks of a flood. The instruments in reducing the risks of a flood have been enlarged with the inclusion of spatial planning and crisis management, but the extend of the multi-layer safety approach is limited, because knowledge gaps exist and thus effects the institutionalization, path development and policy design on flood risk management negatively.

The multi-layer safety approach does link different domains to have a broader instrumentation on reducing the risks of a flood. Multi-layer safety is contingent on the combination of measures from different domains, otherwise it would not be called multi-layer safety. Linking the domains of water management and spatial planning is needed as soon as possible in the process to acknowledge a deliberate interdependency between the domains and to have a foundation for smart combinations with measures from these domains. Smart combinations and could be an alternative for dike reinforcement or link a dike reinforcement with optimal use of (spatial) opportunities or meekoppelkansen (Ellen and Buuren, 2014). The cases investigated in this research have shown that either a water management ascendancy or a spatial planning ascendancy is inflicting a comprehensive and deliberate consideration on measures from domains in flood risk management.

"Institutional change is necessary so that policy processes allow decisions to be informed and made differently and more attention must be paid to the mechanisms of such change." (Dovers and Hezri, 2010, p.212). The question you could ask is whether you wait for more details or you just search for your own capacity on adapting to the system.

6.1 Theoretical discussion

Institutional change

The foundation of this research was institutional change in flood risk management. This change is approached form two points of view, reaction based approach, towards an adaptive based approach and the inclusion of consequence reduction in the flood risk approach. A central role is the domain of spatial planning in this changing policy domain. The role of spatial planning is suggested in this research as part of the flood risk management approach and therefore adding weight to the reduction of flood risk. However, in this research it has not always been the case that spatial planning is used to reduce the risks of a flood, but is seen as adding spatial quality to the area. In this case it was not possible to approach the spatial planning domain on the view of spatial planning in flood risk management as a measure or tool in reducing the risk of a flood.

The theory of institutional change has been approached from the perspective of institutional barriers. This perspective focusses on the failures institutional change instead, where the role of success is an ancillary element in this approach. The answers to overcome these barriers however, are the success factors but result from the barrier point of view. This research did not focus on direct success factors on the institutional change in flood risk management.

Path dependency

The path dependency theory has shown how path dependency could be of large influence on the whole process of flood risk management. A path chosen could determine the pathway down towards the end result. If other paths are being introduced during the process, it could be hard to line up both paths. Most of the cases investigated have shown that the first path for development is major in the process and other development paths have to be adjusted to this major path.

The conceptual pitfall of this theory is to approach each factor in flood risk management from a path dependency theory. *A path-dependent process or system is one whose outcomes evolves as a consequence of the process's or system's own history* (Martin and Sunley, 2006, page 399). The real task of this theory was to stick to the system of spatial planning in flood risk management. Other (indirect) elements in the system of flood risk management could influence the evolvement of the path dependent process, but if you approach these elements also from a path dependent theory, you could end up in an infinite crossing of paths. A broad approach of path dependency in flood risk management could reveal influential aspects, but during this research I had to focus on the spatial planning domain in flood risk management.

Policy design

The theory of policy design is used to see how the evolution of the system of flood risk management (path dependency), together with the changing institutions in this system, is translated in a policy design and could explain the difficulty and complexity faced by policy makers to implement flood risk management. The policy design is used to see how targets are achieved and which strategy is used and how tools and measures from the spatial planning domain play a role in it. Most of this information is interwoven in the other two theories. It was not always possible to describe the element of policy design in detail, because the some of the administrators interviewed, could or would not explain how choices on the domains of spatial planning and flood risk management were made. For instance, in the case of the Willem-Alexanderhaven in Roermond, where a part of the terrain is made water safe by the use of a sheet pilling wall and the other part is made water safe with integral heightening. Certain indicators have been of influence on these different choices, but it was hard to get insight in how these choices have been made.

Entrepreneurship

The role of entrepreneurship is of bigger importance than estimated beforehand. There is no emphasis from the theoretical framework on this element, but it is embedded through the whole theoretical framework of this research. The term 'entrepreneur(ship)' is used in most of the theories, but is also referred to as 'collective actor' (Healey, 2006), 'political leaders' (Dahl, 1961), and 'advocates for proposals' (Kingdon, 2002). Entrepreneurship has been of large influence in the changed institution of flood risk management and the institutionalization of it to create new paths of development. Consequently, the role of entrepreneurship has been elaborated more upon.

6.2 Research design discussion

Practical limitations

The timeframe for this research of six months limited this study. More time might have led to a more elaborated analysis of the cases or would have allowed for more case studies. This might have hampered the domains of spatial planning and water management studied and how these different domains look from their point of view on flood risk management. The cases were investigated with in-depth interview with people from the different domains; water management and spatial planning, but there was no clear strategy on the different viewpoints from these domains. This research is limiting in a more elaborated analysis on the views from the two domains.

Influence of the researcher

Qualitative research has an interpretative character and the research is based on an involvement of the researcher with participants (Creswell, 2014). This includes strategic, ethical and personal issues into the research process (Locke et al., 2013) in (Creswell, 2014), which should be made clear.

The topic of this study was drawn from the Capita Selecta 'Planning for flood risk management'. This Capita Selecta has elaborated upon the different elements in the interdisciplinary field of flood risk management

and shaped my understanding in the context of spatial planning in flood risk management and enhanced my awareness and knowledge on the topic of this research. This bias may shape the way I view and understand the data collected and interpretation of the experiences. The role of the participants is also of influence on this research. They might have pushed the research into a certain direction because they have influence on the information they bring to the table. The research was focussing on the element of spatial planning in flood risk management and certain dimensions on this role might have emphasized upon for their own benefits. The other dimensions might have been neglected because the damage it could bring to them. At last, my personal characteristics could have influenced this research. Characteristics, like being student. This might influence the effort a participant is willing to take for this interview; it is on a voluntary basis and they have to see the value of your research. Being a student could also have been of influence in the discussions I had with some interviewees, where I sometimes had the feeling they saw me as a wiseacre.

Reflections on the conceptual framework

The policy sciences provided the theoretical framework for this research focussed on the institutional barriers of spatial planning in flood risk management together with the theories of path dependency and policy design. The theories chosen overlap each other with certain elements. This could be described as 'theoretical pluralism' where theories overlap and could subsequently inform each other (Huitema and Meijerink, 2010), based on the theory of (Dewulf et al., 2008) as an aid to reflexive critical thinking across the social sciences (Bohman, 1999, Healy, 2003). According to (Scherer, 1998), theoretical pluralism is justified if it resolves incommensurability[1]. In this research it is not an object to resolve incommensurability, but it *"can present a map of possible compatibilities when addressing matters of political concern"* (Sage et al., 2014, p. 546). This research assessed the extent of spatial planning in flood risk management on a case study design to specify which institutional barriers there are in the use of spatial planning as risk reductive measure.

Research design limitations

This research focussed on the domain of spatial planning in flood risk management. The borders of the spatial planning domain are hard to determine, due to a large overlap in measures and tools in the domain of spatial planning and water management. For instance, building a dike. The domain of water management determines the preconditions for the dike, but the implementation of the dike could be approached from the spatial planning domain. The overlap between the domains of spatial planning and water management made it difficult to determine which measure or tool belongs to which domain. This is also of influence on the definition of measures from the multi-layer safety approach. The difference between the layers has been expound, but still leaves room for discussion. This could be made even more complicated if you look at the designed role of spatial planning in flood risk management, reducing the consequences of a flood, where spatial planning could also contribute in the prevention a flood.

The initial idea for this study was to investigate the policy perspective of the multi-layer safety approach and the role of spatial planning in creating water safe environments from this multi-layer safety approach. The research was based on the difference in policy and application of spatial planning in flood risk management. This set-up of research has been changed due to several aspects.

First the multi-layer safety approach is a new approach in water safety and the approach could be placed in its preformation phase. Organisations are trying to implement the approach in their policies, and some have succeeded herein, and some did not. The non-successive organisations are not very open for a study on the topic of the multi-layer safety approach. Unfortunately, I had selected a case where the multi-layer safety approach played a role in the plan making, but has not been executed. To research such cases is asking for non-success factors and not everybody is willing to speak about it. Second, the multi-layer safety approach is a tool and not a target. It is not elaborated upon in policy documents as a concrete target in the water

[1] Based on the view of incommensurability by Kuhn in The Structure of Scientific Revolutions (1996): *"The methodological standards employed in science depend upon paradigm and are subject to variation with change of paradigm. [..] The principal role of methodological standards relates to the puzzles which are the main focus of normal science. The standards take the form of rules of puzzle-solving adequacy which, along with the puzzles themselves, derive from the reigning paradigm. [..] Because puzzles and rules of puzzle-solving derive from specific paradigms, a change of paradigm gives rise to a change in rules as well as to the puzzles addressed in normal science under the new paradigm"* (cited from Sankey, 2013 p. 34-35). A shift in paradigms means also a shift in standards used, there is no common standard. Thus there is no logic reason to choose between the two theories of the paradigm. This is called incommensurability.

safety policy, but multi-layer safety is found within a combination of measures. The multi-layer safety approach could be set as precondition in a plan, where certain elements of the multi-layer safety approach are there, but these elements are not the target to develop from.

The hard target of multi-layer safety was not present in all cases investigated and therefore it was not possible to make a good comparison on the spatial planning measures in the multi-layer safety approach in flood risk management. The goal of this research had to be changed due to this fact. From a role of spatial planning in the multi-layer safety approach to a larger extend; the role of spatial planning in the water safety domain. This larger scope of spatial planning in the domain of water safety made it possible to investigate spatial planning in all cases and was not bounded to the role of spatial planning from the multi-layer safety perspective.

Invitations for in-depth interviews have been sent to the organisation via the secretary of that organisation to be referred to the person(s) responsible within the research target. This open approach of inviting together with the period in which these invitations where sent, the summer holidays, had a large influence on the response to these invitations. I had to call directly for further response and even with these phone calls the response on my invitation was reluctantly low. "Invitation had not been received so if I would send my invitation again." "Person(s) responsible was/were on a holiday so if I could call back later." "The invitation was sent to the department within the organisation but no response on it; an extra message for response was sent from within the organisation." "Too busy, no time for in-depth interviews." These are only a few examples of the response and it was very hard to get in direct contact with the person(s) responsible. Maybe, further research within the organisations could have provided me direct names to contact. In this way, I could have passed the secretary and have got faster direct contact.

The right thing I had done was to make notes of the attempts of contact. Every time I had sent a mail or phoned, I wrote down the date and whom I had contacted. This list provided me proof that I had tried several attempts to contact the organisation. Especially the list of email dates was a good tool for response, because most organisation are striving for response within two weeks. The list of email dates was the proof of contact and from this list I could make a clear and strong message to them on response and it was lacking. If the organisation was confronted with this lacking response, the response rate was much faster from here on.

The invitations did also contain the question if additional case related documents where available on the topic of this research. These documents could be used as a direct source for the interview; I as a researcher had a direct foundation for extra documents and the interviewee could provide documents which he also was aware of. But this approach did not work out as intended. The response to provide documents was very low and I had to use my own found documents to array my interviews. This sometimes resulted in a question where I got my documents from. Or even no response on the questions related to policy documents, because the interviewee was not aware of the document and/or did not support the conclusions in the document. These situations had a large effect on my interview questions and my interview structure, because I had based my interviews on the case related documents I found myself. This sometimes meant a large part of my interview questions were not usable and I had to improvise to get a result I could work with.

Suggestions for further research

This research consisted of different case studies which have given insight on the institutional barriers on spatial planning in flood risk management and how spatial measures and tools are used in order to work towards flood safe environments. The design of the policy on water safe environments is in the clear formulation and use of tools and measures. The cases researched somewhat general and leave room for more in-depth research. Some of the cases researched, could be used as a single case design in a master thesis outline.

The multi-layer safety approach has only successfully been institutionalized as precondition in the development of the area. Additional research could be done in the domain of the multi-layer safety approach to underpin, refute or elaborate on the adequate use of spatial planning in flood risk management. This research has focussed on the institutional barriers of spatial planning in flood risk management. Follow-up research could be done by investigating how different layers in the multi-layer safety approach could be used

interchangeable in developing flood safe environments and what is needed to make interchange happen and successful. Also the role of an entrepreneur on the institutionalization of policy change could be a topic to investigate.

The multi-layer safety approach has introduced a wider focus on integrated flood risk management (Schultz van Haegen and Wieriks, 2015). The cornerstone of this wider integration is the focus on the prevention of floods and wherein the safety norm has to be met. This research has shown that plans on creating water safety from the second layer have been developed, but are not implemented because measures from the different layers are not interchangeable. Additional research could be done to investigate what has to change in order to make measures from different layers interchangeable.

7 Conclusions

The purpose of this study is to explore the usage of spatial planning as risk reductive measure in flood risk management and the link between water management and spatial planning in flood risk management. The link of spatial planning and water management has been explored. New concepts on reducing the risks of a flood are introduced with a focus on the prevention of floods together with keeping the consequences of a flood as low as possible. The role of spatial planning in the water safety domain is emergent and therefore this research looked at the role of spatial planning in this domain.

The conceptual framework of this research, consisting of theories on path dependency, institutional change and policy design, is used as a theoretical lens in this research to reach the aim of exploring the role of spatial planning as risk reductive measure in flood risk management and to see if the domain of flood risk management has shifted away from the single objective of flood defence, towards the connection of different policy field with the use of multiple tools or tool mixtures to address the multiple goal orientation on flood risk management. Therefore, the following research question was used for this research:

> **Which institutional path dependence processes could be determined from the use of spatial planning measures and tools in the flood risk management approach?**

To answer this main research question, the following sub-research questions were guiding:

1. What use is made of spatial planning in flood risk management?
2. What is (institutional) path dependency and which paths could be drawn from the use of spatial planning in flood risk management?
3. Which barriers arise from institutional path dependency in the use of spatial planning in flood risk management?

This research has shown a large complexity concerning the use of spatial planning in flood risk management. The role of spatial planning is versatile and does vary a lot from the different cases investigated. To explain this versatile role, I go back to the first sub-research question: What use is made of spatial planning in flood risk management? Spatial planning could fulfil a role on improving the spatial quality of the area. In such cases it does not contribute to water safety, but does improve spatial quality besides water safety measures from the domain of water management. The other use of spatial planning in flood risk management refers back to the role it could fulfil from the multi-layer safety concept. In this concept spatial planning fulfils the role on reducing the consequences of a flood. This could be a combination of prevention with measures from the domain of water management and consequence reduction with measures from the spatial planning domain. This is also described as smart combinations. Combining prevention and consequence reduction. But the element of consequence reduction could also be a stand-alone measure in, for instance, outer dike areas. Here there are no other defence mechanisms and spatial planning could work as a consequence reductive measure; it is not possible to prevent a flood in these areas.

Spatial planning could also contribute in the prevention of floods. As stated in the problem statement the role of spatial planning could be more diverse than the role described in programmes like Room for the River and the multi-layer safety concept; reducing the consequences of a flood. This research has shown that also the prevention of floods could be approached from the spatial planning domiain. The floodplain park in the harbour of Roermond and a regional defence system by filling gaps between natural heights to create a flood defence line in the landscape near the city of Zwolle proof that the role of spatial planning is more diverse.

The new policy on flood risk management has a link with the physical safety paradigm from past flood risk management conceptualizations (Hurk et al., 2014). This physical safety paradigm is based on the prevention of floods, which is the cornerstone of the multi-layer safety approach and embedded in the first layer. The policy on path dependency could be seen as a perspective on dynamic increasing returns where *"...the argument that the development of many phenomena is driven by a process of increasing returns, in which various externalities and learning mechanisms operate to produce positive feedback effects, thereby reinforcing existing development paths"* (Martin and Sunley, 2006, page 400). New paths could be created in situations when actors within the process are able to access, understand, and convert knowledge, into new path or renew older ones (Martin and Simmie, 2008). where the multi-layer safety approach has shifted the policy on the prevention of floods with the addition of reducing the consequences as well.

What is (institutional) path dependency and which paths could be drawn from the use of spatial planning in flood risk management? The new policy concepts within flood risk management have created new paths of operation where the current system, a focus on flood prevention conditioned from the past, has shifted and the element of consequence reduction is added to flood risk management. The dominance of the physical safety paradigm has shifted and the consequences of floods are added to the domain of flood risk management; changing the approach of flood risk policy and introducing a range of measures to prevent, mitigate, prepare and reduce the vulnerability on floods.

Path dependency has provided insight in the interrelationship between flood risk management and spatial planning in the context of developing the flood risk management policy and the realization of adaptive plans (Hetz and Bruns, 2014) to control floods. The multi-layer safety approach is in the preformation phase and the policy has to be shaped and implemented. Testing grounds have been set up with clear objectives on providing knowledge and experiences in the national policy on flood risk management in order to develop a vision on the water safety policy in order to improve the water safety aspect (Oranjewoud and HKV Lijn in Water, 2011). *"The existing structures and paths – that together constitute the 'preformation phase' – provide the stimulus for, and shape the scope of, new opportunities […] and institutions.* (Martin and Simmie, 2008). The existing structures have shifted to a wider focus on the on the prevention of flood, the cornerstone of flood risk management, with the addition of spatial planning and crisis management (Schultz van Haegen and Wieriks, 2015).

Path dependent processes are incorporated from regional perspective where the development path chosen suits the regional water safety task. It is therefore not possible to describe a standard development path for flood risk management. This research has looked for case dependent paths and how these paths are of influence on spatial planning in flood risk management. Paths arise from the programmes in flood risk management. The programmes have certain prerequisites which have to be complied in order to achieve the goals on water safety. Stimulus to develop from these programmes are the funds provided within these programmes. These programmes determine the path of development and is generally determent for the other paths implemented later in the process of flood risk management. This research has shown that a development path could arise from the spatial planning perspective as well as the water management perspective. Linking the paths from these two domains could be difficult, because a link between the spatial planning and water management is weak or indirect (Woltjer and Al, 2007). The 'old' paths in flood risk management still exist, where the domains of spatial planning and water management are treated as different modes of governance (Hartmann and Driessen, 2013). New policy strategies have strengthened linkages between water management and spatial planning (Woltjer and Al, 2007). The importance of a link between space (spatial planning) and water (management) is emergent were and as the risk based approach is considered from the consequences of a flood as well (Zandvoort and van der Vlist, 2014). A broader focus on prevention, mitigation, preparedness and vulnerability reduction is needed (Schultz van Haegen and Wieriks, 2015). Linkage of the domains of water management and spatial planning could acknowledge a deliberate interdependency between the two domains and could result in a better foundation for smart combinations of the measures from these domains. Adequate spatial planning could prevent a dike rise in the future, when a clear pathway of policy and technical action is constructed. The investments on risk reduction are short term investments, but the recovery of these investments will be on the long term, when these investments could prevent a dike rise long term.

The level of uncertainty in the multi-layer safety concept is of large influence on the institutionalization of this new concepts. Long term certainty is required to institutionalise the multi-layer safety concept. Because the knowledge about the long term development of the multi-layer safety concept contains gaps, the institutionalization is limited. The multi-layer safety concept and its policy is under the influence of change. By answering the third research question: 'Which barriers arise from institutional path dependency in the use of spatial planning in flood risk management?' the barriers of institutional path dependency in flood risk management will become clear. *"The purpose for the rules [the institutions] is to define the way the game is played. But the objective of the team [the organization] within that set of rules is to win the game – by a combination of skills, strategy, and coordination.* (North, 1990, cited from Moroni, 2010, page 277). The rulebook of flood risk management has been changed. Via testing grounds the changed institution of the multi-layer safety concept is tested and provide knowledge and experiences in order to improve the multi-layer safety concept in particular, and the water safety aspect as a whole. The testing ground principle acknowledges knowledge gaps in the multi-layer safety concept. Institutionalization is building on knowledge

and these knowledge gaps are the barriers in institutionalization of the multi-layer safety concept affecting the adaptation of this concept. The *"…financial, technological, cognitive, behavioural, political, social, institutional and cultural constraints limit both the implementation and effectiveness of adaptation measures"* (Dovers and Hezri, 2010). This research has shown that some of these assets are a constraint and limit the implementation and effectiveness of the multi-layer safety concept. Actors within the process are not able to access, understand, and convert knowledge, into new path or renew older ones (Martin and Simmie, 2008).

By answering these sub-research questions, the main research question "Which institutional path dependence processes could be determined from the use of spatial planning measures and tools in the flood risk management approach?" could be answered. The cornerstone of the flood risk management policy is the prevention of floods and the safety standards are embedded in the primary flood defence system. New insights in climate change and socio-economic developments have given urge to a broader focus on prevention, mitigation, preparedness and vulnerability reduction of floods. The multi-layer safety concept is conceptualizing this broader focus by preventing flood with hard-core flood defence systems and in addition the use of spatial planning and crisis management to reduce the impacts of a flood. This research has shown that paths could be developed with the use of spatial planning on the prevention of flood and reducing the consequences. But the development of these paths do include elements of uncertainty. Because the safety norms are embedded in the primary flood defence systems, layer one of the multi-layer safety approach, the incentive to invest in spatial planning measures is missing. Investments in spatial planning measures are water safety measures considered as extra, because the safety norm has to be met with measures from the first layer of the multi-layer safety approach.

The multi-layer safety approach does link different domains to have a broader instrumentation on reducing the risks of a flood. Linking the domains of water management and spatial planning acknowledges a deliberate interdependency between the domains and could be a foundation for smart combinations with measures from these domains to a comprehensive and deliberate consideration on measures from both domains in flood risk management. Smart combinations and could be an alternative for dike reinforcement or link a dike reinforcement with optimal use of (spatial) opportunities (meekoppelkansen) (Ellen and Buuren, 2014). But the path of preventing a dike reinforcement with the use of spatial planning measures is making use of short term spatial investments which have a long term return, with the possible prevention of a dike rise. The institutional constraint on interchangeability however, is limiting the implementation of spatial planning measures in the flood risk management policy. Spatial planning measures could not interchange primary flood defence measures now and thus the development of this institutional asset is a constraint in the acceptation of the multi-layer safety approach.

This research has tried to explore the institutional barriers on the use of spatial planning in flood risk management. Because institutional barriers exist the development of paths in the multi-layer safety concept is influenced by missing the knowledge in the long term development of this concept. The concept is changing its institutions. The barriers form this research could help in the reflection on the use of spatial planning in flood risk management. The role of spatial planning is emergent within the flood risk management policy and this research has shown that spatial planning measures could fulfil a versatile role in reducing the risks of a flood.

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