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Water Governance Assessment of the Flood Protection Policy in Dordrecht



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1 Introduction

The Netherlands is entangled in an ever during - perhaps existential - conflict with water. After centuries of introducing and enhancing flood protection, flood-prone areas of the Netherlands are protected by over fifty dike rings (Hoss, 2009). The works are certainly not finished: climate change, sea level rise and subsidence of ground tend to increase the difference between sea and ground level. The 'proven' method of upgrading flood prevention becomes increasingly difficult and costly: in densely populated areas where space is scarce strengthening dikes is technically challenging. In social-economic terms, growth leads to a higher flood risk since the assets increase: dikes must be enforced to protect inner valuables. Further growth asks for new investments, which could become a financial burden for cities and provinces. Adaptation and mitigation to a changing climate and different water conditions are ranked high on the national policy agenda. On European level, policy makers have decided that member states have to construct flood risk maps for all waterways and coasts, and come up with risk management plans (EU Flood Directive, 2007/60/EC). Before this implementation, the Dutch national policy was comprised of decreasing probability. The new method could be considered as an 'integrated risk approach', meaning that the consequences of flooding must be taken into account as well.

One city in particular which is prone to floods is Dordrecht, in the province Zuid-Holland. Dordrecht, with a population of about 120.000 inhabitants, is the fifth largest city of Zuid-Holland. The wider area is known as 'the Island of Dordrecht' – Dordrecht is an island surrounded by four rivers. These rivers are susceptible to flooding, as their water heights and quantity are both influenced by the North Sea and Netherlands' rivers. Among Dordrecht's valuable and vulnerable assets are the port and historical centre, both attractive for tourists - but located party outside a dike ring. This ring carries multiple monuments, so strengthening is a difficult issue. The city of Dordrecht is very well aware of its vulnerable position. A solution was found in the concept of 'Multi-layer safety' (MLS). This new policy is strongly appraised in the National Waterplan as a good way to address water risk. But critical voices argue that the policy is still in its infancy and its implementation too narrow. Questions still remains open.

In this paper, the issues were taken up and the Multi-layer safety policy will be verified. The case of Dordrecht according to the ten building blocks approach, in assessing water governance. In doing so, the underlying aim is the identification of benefits, problems in order to give recommendations. Therefore, the research question is: If and why or why not the Multi-layer safety policy is the best way to address flood risk in Dordrecht?

In chapter 3 the current situation of each building block will be explained, whereas in chapter 4 the gaps and improvements will be assessed and in part 5 discussed. At the end a conclusion will be provided.

2 Methodology

The Water Management and Governance Assessment Method was applied in order to assess the Flood Protection Policy by means of the case Dordrecht. According to Van Rijswick et al. (2014), the method can be used to “assess the main gaps in (1) the knowledge base, (2) weaknesses in the organization process, and (3) problems” with the implementation (Van Rijswick, Edelenbos, Hellegers, Kok & Kuks, 2014, p. 72). In a further step, the method is divided in 10 building blocks with which the various aspects of water governance and management are covered (see figure 1).

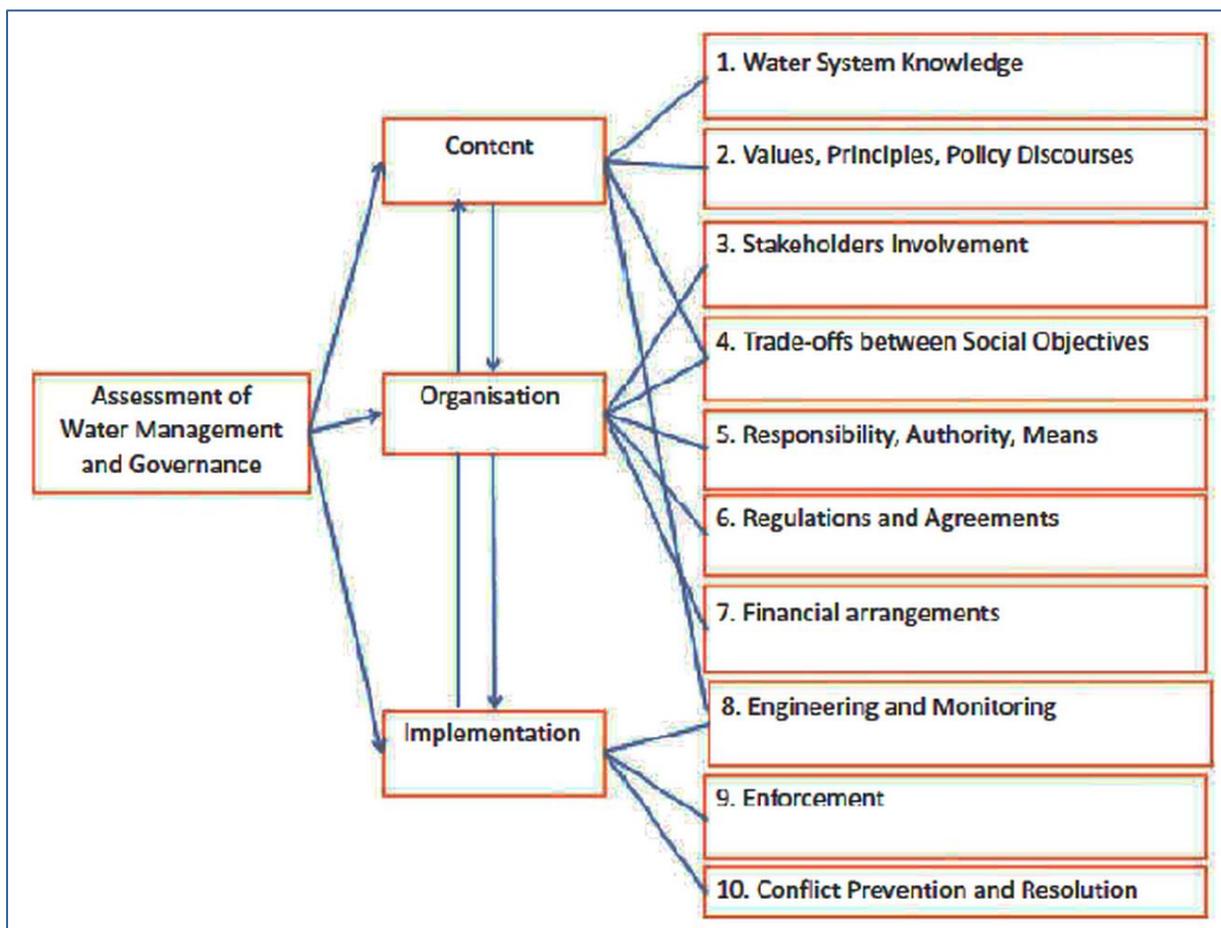


Figure 1: Multiple dimensions of water management and governance (source: Van Rijswick et al., 2014).

For the paper the assessment criteria provided by Van Rijswick et al. (2014) were used. In the **water system knowledge** block the level of sufficient knowledge was examined. The relevant gaps and problems were analyzed in chapter 4. The same procedure was applied for the **second block**. The current values, principles and the policy discourse were shown and the sufficient level of knowledge about the shared ones identified. For the **stakeholder involvement** block it was important to know how wide and deep the stakeholders participate in decision-making processes or in processes in order to find alternatives and solutions. In the **next block** the trade-offs between social objectives were figured out and potentially arising conflicts discussed. The next step contained the **assessment of authorities, responsibilities and**

means while looking for the organization efficiency level of these entities in a participative and integrative way. **Regulations and agreements** were appraised based on their legitimacy and adaptiveness. The possible problems regarding the block were identified in chapter 4. The **financial arrangements** were evaluated referring to their level of sustainability and equity. The **engineering and monitoring** block were assessed by means of the sufficiently availability of service-level agreements (SLA), alternatives and monitoring mechanism. The criteria for the **enforcement assessment** contained the question if and how public and/or private stakeholders could constrain regulations and agreements? The **last building** block was evaluated under the condition if sufficient conflict prevention and resolution strategies are existent or not. Good water governance and management is a complex issue. Especially, climate change, socio-economic, spatial-demographic and political trends challenge the efficiency, effectiveness and legitimacy of water governance and management. Therefore, the assessment method provides a good approach to identify the current state of the water system and on the other hand gaps or problems in order to improve existing water management and governance structures.

As data base for the assessment wording the law, scientific and publically available, governmental literature were used and the content analyzed interviews or questionnaires weren't applied. But the information acquired from the literature was sufficient for the requirements and length of the paper.

3 Flood Protection Policy

The current flood safety policy bases on the perception that flood probabilities are mitigated “while relying on innovative yet expensive technical solutions, as well as, limited integration of water safety within other policy disciplines” (Jonkhoff, 2009, p. 222). For several years, this perception has begun to change: For instance, the ‘Room for the River’ project and the Multi-layer safety approach are indicators of the changed perception (Ministry of Infrastructure and Environment, 2009). Because of Dordrecht’s spatio-economic peculiarity the Multi-layer safety approach with a ‘smart combination’ of different adaption measures as flood protection policy was implemented. MLS has three layers: (i) prevention (e. g. the strengthening of dikes), (ii) spatial solutions (e. g. elevation and flood-proving residential houses) and (iii) crisis management (e.g. faster evacuation methods, early warning systems). The key aspects of MLS are focused on a) probability reduction and b) loss reducing measures (Hoss, 2009). This approach ought to ensure the objectives for flood risk management, efficiency, adaptive and spatial development possibilities while avoiding unnecessary costs (Gersonius et al., 2014). Following, the current state of the building blocks will be briefly described.

3.1 Water System Knowledge

The consultation of various stakeholders (e. g. authorities, knowledge institutions, engineering agencies, market parties and engineering consultancies and social organizations) was incorporated in the National knowledge and innovation agenda 2009 – 2015 and is realized in the different programmes, projects, platforms (e. g. Knowledge Platform Water) and conferences which provide a multilateral basis for decisions in policy making. In the case of Dordrecht the risk of flooding is documented very well based on the participation in different national programmes (e. g. Dutch Delta Programmes, Flood Protection Programme), protection standards for the dikes and plans (e. g. Provinciaal Waterplan Zuid-Holland 2010 – 2015) which are publically available. The flood defence structures in Dordrecht are evaluated periodically against the national standards based on the KNMI-2006 climate scenarios of the Royal Netherlands Meteorological Institute in combination with socio-economic scenarios (Gersonius, Kelder, Anema, van Herk & Zevenbergen, 2014). The municipality of Dordrecht launches publicity campaigns and performs other events (e. g. evacuation exercises once in a year) distributing information about flood risk (Geemete Dordrecht & Waterboard Hollandse Delta, 2009). The government and the regional authorities have been started a *Multi-Year Plan for Infrastructure, Spatial Planning and Transport (MIRT)* study to examine more information, especially about the set of 'smart combination' measures.

3.2 Values, Principles, Policy Discourse

In general, the main stakeholders responsible for flood risk protection displayed in figure 2 are the following: the Ministry of Infrastructure and Environment, the national Water Authority, the Regional water authorities and applied on the case of Dordrecht the Municipality and the citizen. The European Union is setting the framework for flood risk management.

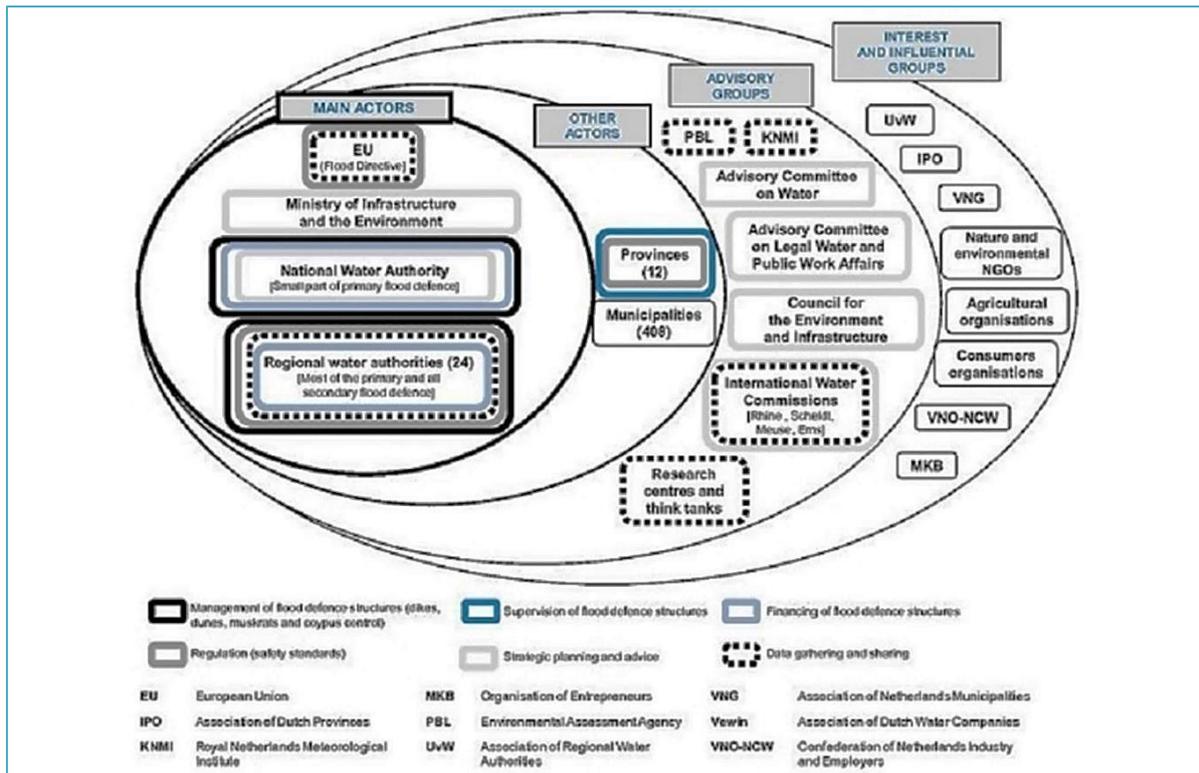


Figure 2: Institutional mapping for flood defence (source: OECD, 2014).

Values

The citizen trust that the government takes care for flood risk prevention and protection. Trust between institutions, especially between the regional water authority and the municipality is important. Therefore, the Dutch Delta Programme is a good way addressing trust building between the different stakeholders. For instance, users of the Delta Web can share documents, either privately or publicly (Delta Programme Commissioner, n. d.b). 

Principles

Flood protection bases on different sets of principles: legitimacy, solidarity, subsidiarity, decentralization, effectiveness and equity.

Legitimacy

The Dutch flood risk management complies with European (e. g. the Water Framework Directive and the Floods Directive) and international requirements (e. g. flood risk safety of the citizen). The Netherlands fulfil all obligations outlined in the Flood Directive¹ 2007 and the report on assessment and management of flood risks: (i) incorporation in national law (Art. 17); (ii) providing relevant and competent

¹ EU Directive 2007/60/EC on the assessment and management of flood risk

authorities or management units (Art. 3); (iii) a preliminary risk assessment (Art. 4 and 5); (iv) creation of flood hazard and flood risk maps (Art. 6) and (v) flood risk management plans (Art. 7). In fact, the Netherlands made use of Art. 13 because flood risk assessment information has been already available before 22 December 2010; “based in part on the former Flood Defence Structure Act” (van Rijkswick & Havekes, 2012, p. 256). In terms of transparency, references can be drawn from the part about water system knowledge. 

Effectiveness

Although, a stronger involvement of private parties is recommended in the Delta Programme 2015, the responsibility of flood protection remains a public matter with the common goal: protection of the citizen’s life and reducing economic loss. This aim ought to be achieved by means of the multi-layer safety approach. It seems that the efforts and the policy objectives are widely accepted by the public. Further comments are described in part 4.2.

Subsidiarity and Decentralization

In the political and economic context the task of flood protection in the Netherlands is decentralized and is acted out by the smallest administrative unit, the regional water authorities, which are perceived as capable and efficient of taking care of this task. Administrative structures like the regional water authorities are necessary because European subsidies were allocated and managed on a regional level required for integration in the European Community. At the same time decentralization supports subsidiarity. Flood protection is a complex issue. Therefore, the citizen and the municipalities are not capable of managing flood protection in a sufficient matter. The regional authorities compensate this ‘lack’ and on a higher scale the central government. But on the other hand, the citizens and companies living and situated outside the first flood defence structures have to take responsibility for themselves in the case of Dordrecht. This strategy is a part of the subsidiarity principles as well and incorporated in the policy for Dordrecht.

Equity and Solidarity

The central government and the water boards have decided that, “from 2014, they will pay an equal share (50:50) of the costs of current and future protection measures” (Ministry of Infrastructure and Environment & Ministry of Economic Affairs, 2014, p. 94). In the context of taxes, equity means that every Dutch citizen pay taxes for managing flood risk. In addition with the solidarity principle all citizen pay whether they live in a flood prone area or not. People who are living outside the dike-rings have to bear additional costs for flood protection measures at their own expenses.

Policy discourse

According to the National Waterplan (2009-2015) the central government and the regional water authorities still focus firstly on flood protection by means of improvement of the flood defence structures based on the current legal standards (Ministry of Infrastructure and Environment & Ministry of Economic Affairs, 2014). Secondly, during the last years different projects and programmes (e. g. 'Room for the River') were launched in the context of flood risk management combined with multi-level governance efforts. The central government commits to a necessary shift in the flood safety policy while adapting a sustainable flood safety policy based on a multi-layer safety approach. The current policy differentiates between areas inside and outside the first flood defence structures. The risk for unembanked areas is perceived as less high than behind the dikes because "the built-up areas do not lie at such low levels" (Ministry of Infrastructure and Environment & Ministry of Economic Affairs, 2014, p. 68). The municipalities and the citizen are responsible for performing protection measures and bear the costs themselves.

3.3 Stakeholder Involvement

The municipality of Dordrecht follows a participative and communicative approach, because they admit that only through a strong and close cooperation with Dordrecht's citizen, firms and other interest groups the goal of a safe and secure island can be achieved (Geemete Dordrecht and Waterboard Hollandse Delta, 2009). According to Dordrecht's Waterplan (2009) the involvement strategy consists of three pillars: (i) publicity campaigns, (ii) information, education, participation and (iii) using chances (Geemete Dordrecht and Waterboard Hollandse Delta 2009). The Dordrecht's municipality shows strong ambitions to involve all relevant parties. Experts from different scientific and practical fields worked together in the international and interdisciplinary UFM project. In general, the municipalities could influence water policy through discussions in the National Water Platform or participation in the Delta Programme. Regardless, the participative role of the citizen is limited on a local scale.

3.4 Trade-offs between social objectives

According to the National Waterplan (2009-2015) the system of standards bases on flood risk has to be determined by means of "incorporating a basic level of safety for every individual, a socially acceptable risk for the risk of large numbers of casualties and an economically optimal level of safety" for each dike-ring (Ministry of Infrastructure and Environment & Ministry of Economic Affairs, 2014, p. 71). Environmental consequences and the costs for the improvement weren't considered as additional variables. In the case of Dordrecht trade-offs could arise between water security objectives, protection of natural landscape, spatial planning, urban development, tourism and recreation. In the context of short-term tasking,

strengthening the dikes is priority. Trade-offs are not available. Medium-term tasking provides trade-offs considering cost, benefits and spatial planning. In terms of long-term tasking options should be kept open for adoption of other strategies. The current evacuation rate for Dordrecht is evaluated by 15% of its citizens because of its spatial feature (Maaskant et al., 2009). The multi-layer safety approach propose the idea of 'safe heavens' for preventive evacuation on the island itself, but concrete ideas how the evacuation rate could be increased does not exist.

3.5 Responsibility, Authority and Means

As with many environmental problems, multiple administrative levels are enforced to tackle the issue. A majority of governance comes from the Ministry of Transport, Public Works and Water Management. As different regions face different problems, more applied policy and strategies is constructed on local regional level, with local knowledge. As prescribed by the National Water Plan, "residents and users are responsible for taking consequences-reducing measures when there is an unacceptable flood risk" (V&W, 2009). Dordrecht, surrounded by rivers and canals is essentially an island. Extreme water is influenced by both river discharge and the sea level. Global climate change will have large effects, and adaptation and mitigation efforts were placed high on the agenda. '*Dordrecht werkt aan water*' (Dordrecht works with water) is project consisting of two participants: the city of Dordrecht and the water board Hollandse Delta. The project is a bare necessity, considering Dordrecht's difficult position as an 'urban island' – measures and precautions must be properly planned and executed. The main goals are progress in the field of water quantity, quality, but of the highest importance: water safety. The joint effort is presented in the Water plan Dordrecht 2009-2015, which is a successor of the Water Plan 2003-2007. This production was awarded 'best urban water plan' in 2003. In the production, there was a close collaboration with other governments, knowledge institutes, local stakeholders, housing corporations and citizens of Dordrecht.

3.6 Regulations and Agreements

According to Gersonius (2012), enhancing resilience to climate change, for example in the form of climate proofing, is developing as the best practice concept in the modification of flooding systems. Protection standards for areas with dike rings are anchored in Dutch national law, in the National Water Plan. Dordrecht's protection level has been set at 1/2000 per year. Furthermore, the Flood Protection Programme aims to enhance and strengthen existing flood defences over for a fifty year period.

In 2009, new regulation strategies were introduced in the form of Multi-layer safety (MLS). MLS serves as an integrated flood management, with one overarching goal: reducing the probability and the consequences of floods. It consists of three layers: (i) prevention, (ii) spatial solutions and (iii) crisis management. MLS combines measures

of a different nature. In the past, only prevention of floods was on the agenda. Layer 1 (prevention) aims to prevent river and sea water from inundating dry areas. Layer 2 (spatial solutions) uses planning and adapting buildings to minimize losses in case of a flood. Crisis management (layer 3) is 'organizational preparation' for floods, and consists of disaster plans, risk maps, warning systems, medical help and evacuation.

The MLS approach puts a halt to the continuous dike reinforcements that the Netherlands used to apply in the past. Mathematically, if the (economic) consequences of floods do not increase, increasing flood defence as has to be done less frequently to keep the existing risk at the same level.

Dordrecht is incorporated in the international project UFM (Urban Flood Management). Together with Hamburg and London, Dordrecht works on the engineering and application of sustainable urban development within three out-of-dike 'test' cases. In developing new housing concepts, special precautionary measures were developed to deal with flood risk. UFM's key targets are climate change and safety: by diversification of building method and experimentation of different water heights, functioning of the houses is guaranteed under all circumstances. Water nuisance should, in theory, be non-existent. Some methods are floating houses, water-resistant ground floors and water deflecting doors.

Additionally, another method as prescribed in the National Water Plan is dry proofing and wet proofing the ground floor. Dry proofing can involve shielding, where flood water is kept out of the building by installing temporary barriers. Wet proofing accepts the water into the premise and involves using materials that minimize the impact of the flooding.

3.7 Financial arrangements

Large scale protection plans ask for a sound financial plan. Projects in the Netherlands often times have financial inputs from provincial, national and European level, such as European Union funds for regional development. According to the Dutch 'Wet op de Waterkering' (Embankment, or Dike law), the water board must enforce fifteen kilometers of the main dike to get them 'in order'. It is the wish of the municipality Dordrecht and the water board to apply the safety norm '*the Netherlands must become tenfold safer*' to the dike enhancement plans. In order to do so, they are dependent on national funding.

	Investering	Gemeente	Waterschap		Investering	Gemeente	Waterschap
 Waterveiligheid				 Watergebruik en -beleving			
Waterkeringen	€ 100.000	€ 50.000	€ 50.000	Water als ontmoeting	€ -	€ -	€ -
Water en Europa	€ -	€ -	€ -				
<i>Subtotalen</i>	<i>€ 100.000</i>	<i>€ 50.000</i>	<i>€ 50.000</i>	<i>Subtotalen</i>	<i>€ -</i>	<i>€ -</i>	<i>€ -</i>
 Waterkwantiteit				 Communicatie			
Water vasthouden en bergen	€ 810.000	€ 0	€ 810.000	Communicatieplan (totaal voor 7 jaar looptijd)	€ 350.000	€ 175.000	€ 175.000
Water en ruimtelijke ordening versterken elkaar							
<i>Subtotalen</i>	<i>€ 810.000</i>	<i>€ 0</i>	<i>€ 810.000</i>				
 Waterkwaliteit				TOTALE KOSTEN GEDEKT DOOR HET WATERPLAN	Totale Investering	Bijdrage Gemeente	Bijdrage Waterschap
Schoon oppervlaktewater en gezonde flora en fauna	€ 380.000	€ 265.000	€ 115.000		€ 1.690.000	€ 515.000	€ 1.175.000
Beheer openbare ruimte	€ 50.000	€ 25.000	€ 25.000				
<i>Subtotalen</i>	<i>€ 430.000</i>	<i>€ 290.000</i>	<i>€ 140.000</i>				

Figure 3: Budget estimates (source: Geertruida Dordrecht & Waterboard Hollandse Delta, 2009 [Waterplan 2009-2015]).

Dordrecht's cost division

Flood protection is part of a larger project (Waterplan Dordrecht 2009-2015). In the above figure (I), the total budget is visualized. Tax is included. Two categories are relevant for Dordrecht's flood protection: 'waterveiligheid' (safety from water) and 'waterkwantiteit' (water quantity). Improving the dikes is estimated at €200.000. This is made up of a €100.000 investment, and €50.000 is contributed by both the city of Dordrecht and the water board Hollandse Delta. The budget is estimated by the previously mentioned 'water partners', making use of local knowledge and experience. They are indicative and, in practice, may turn out cheaper or more expensive. As part of the cost distribution, the task description from the water partners was taken into account, most notably Dordrecht and Hollandse Delta. For the majority of the plans, the costs are evenly split. In a large number of projects, third party financing is incorporated. In splitting the costs, the 'cost causer principle' is applied.

Cost recovery

A large share of the costs is covered by existing: effective policy KRW (Water Framework Directive), GRP (Municipal Sewer Plan), NDB (project the new Dordtsche Biesbosch) and MARE (EU-project Managing Adaptive Responses to changing flood risk). For the remaining finances, other sources must be administered. The Municipal Waterworks law (2009) offers opportunities for financing certain measures. From fellow governments, possibilities exist for co-financing, that is: when new measures fit into existing specified general (or specific) policy goals like e.g. urban renewal, nature development, milieu and water storage. Co-financing is spent on research, execution and education purposes.

The Netherlands: financing flood protection

According to the National Waterplan 2009-2015 (2009), €5 billion is spent per year by the government, provinces, water boards and municipalities on water themes. A significant part is spent on flood protection. Roughly 25% of the costs is funded on a national level, the remainder by tax-fuelled water boards and municipal councils. Investments have risen by flood safety programmes, like the Flood Protection Programme, Water Management in the 21st Century and the Water Framework Directive. Honoring recommendations from the Delta Committee, the government will invest more in flood protection and fresh water supply in the near future. A new, vast Delta Fund will come into existence, which will allow implementation of the Delta Programme. From 2020 onwards, the Infraconds will deposit at least one billion per year.

The 2006 dike, dune and coast-check concluded that many flood defences 'were no longer up to scratch' (National Waterplan 2009-2015, 2009). The Flood Protection Programme, to cover all necessary measures, has a budget of 2.5 billion euro for the period 2009-2020. Climate change, improved standards and subsidence are factors that have led to the notion that flood defence needs significant investment, the Delta Committee claims. An estimate of the Committee has been that investments of around 1.6-1.7 billion euro must be done yearly until 2100.

3.8 Engineering and Monitoring

The island of Dordrecht is located in a transitional region, where the alterations in both sea level and river discharge may threaten the water regime integrity of the island. The water discharge is from the two rivers Rhine and Meuse with the former one to play a most significant role to the water status of the area. The local authorities and the Dutch government by paying attention to the vulnerability of the region, they have taken measurements against flooding. The main engineering infrastructure of the area is based on:

- The Maeslant barrier in the Nieuwe Waterweg (figure1)
- The Hartel barrier in the Hartelkanaal (figure2)
- The locks in the Haringvliet (figure 3)



Figure 4: Maeslant barrier in Nieuwe Waterweg (source: Rijkswaterstaat, Netherlands—Geo-Information and ICT (AGI), Retrieved from <http://www.deltawerken.org>).



Figure 5: Hartel barrier in the Hartelkanaal (source: <http://www.deltaworks.org> / Author: DeltaWorks Online - Job van de Sande).



Figure 6: The locks in the Haringvliet (source: <http://iv-groep.nl/en-US/Markten/Water/Water-quantity/Renovatie-elektrotechnische-installaties-Haringvliet>).

The first two barriers are open channels, which can be barred when it is required. All the three constructions are based on the flow of the Rhine River, while the lock in Haringvliet depends on the flow in the location of Lobith. The locks in the Haringvliet are closed when the river discharge is lower than 1.200 m³/ s, while they are fully open when the discharge is about 10.000 m³/ s (Gersonius et al., 2012). The Maeslant barrier is very significant for the protection. It closes when the water level exceeds NAP +3.0m and it is already designed to cope with a sea level rise of 2,5m and it can be easily accustomed to deal with a sea level rise of 5m. The island is

protected by a dike ring which has 37, 1 km length and it consists the primary flood defense of Dordrecht. It was established by the national law so as to meet the national protection standard (VenW, 2010).

Despite the measures that have been taken, there is a fragment of the city that is outside the elementary flood defense infrastructure. Those areas are called “unbanked areas” and they are located in a high altitude so as the two barriers Maeslant and Hartel are not able to protect them in high-scale flood occurrence. The historic port area of Dordrecht is in the height of +1.7m until +2.5m and it is considered the lowest unbanked area.

In the future, the climate change compromises a sea level rise and as a result, there will be the need for more adequate flood defenses. The costs for these strengthening measures seem to be very high and also sometimes sociably unacceptable. One example of a social unacceptable measure is the reinforcement of the flood infrastructure in the street Voorstraat in the historic center of Dordrecht. Local people disagree in the reinforcement of this structure as its height is totally insufficient to defend extreme flood events. Moreover, a new construction will deteriorate the historic atmosphere of the center. According to future scenarios, the frequency of floods will remain under controllable levels until 2050 (high-climate scenario) (KMNI’06 W+ scenario) while more extreme phenomena will occur in 2100 (medium scenario) / (KMNI’06 G scenario) (Hurk van den, 2007). In the figure 4, we can see the two basic scenarios in the main protection in the island of Dordrecht.

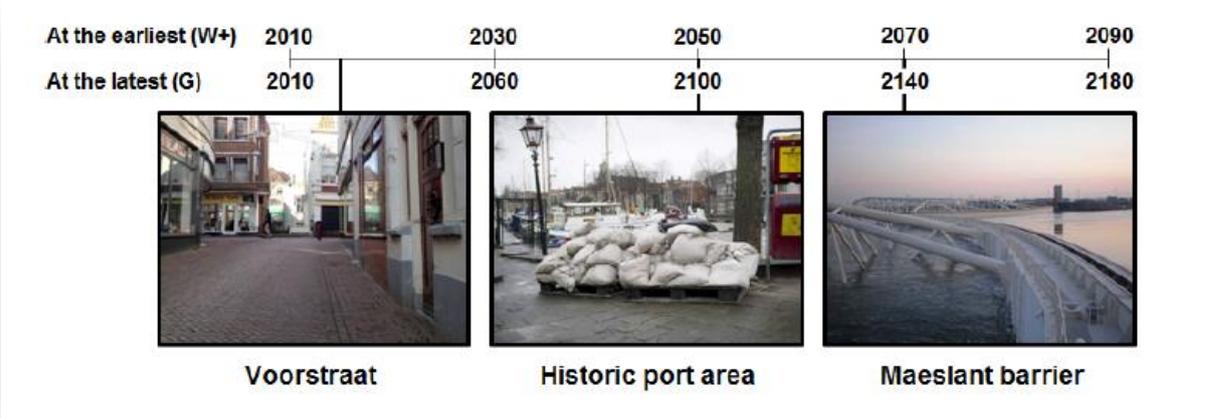


Figure 7: The earliest and the latest climate scenario for the infrastructure of Dordrecht (source: Gersonius et al., 2012).

The flood defense assessment is based on two basic factors: the protection standard and the design water levels. In the 3rd statutory assessment of the island of Dordrecht, it appears that the flood defense infrastructure is 28% below standard and they require fortification (PZH, 2011). All the reinforcement measures are becoming part of the Flood protection Programme, which has a goal to reinforce insufficient flood defenses in a period of 50 years (IenM, 2011). The continuity of the every five year estimation of the flood defense and the appropriate implementation of the flood

protection program are significant elements that play a major role in monitoring the current situation and ameliorate all the weak parts occurred in the future.

3.9 Enforcement

The enforceability of rules and settlements instituted among the different authorities or political parties is totally depended on the agreement of all the factors about whatever has been established so far. This procedure is quite difficult to be achieved and specifically in the Netherlands this occurs because every province can act very independently for the current issues.

Concerning the public sector, on the top of the pyramid is the EU Flood Directive (2007/60/EC) which forces all the state members to follow sufficient plans against flooding phenomena. The Dutch government has put this issue of a great significance in the National Water plan in 2009, so as to take into account the flood risk and establish measures against it. The National Waterplan (Rijksoverheid, 2009) includes all the water management agreements against flooding for the period 2009-2015. The measures taken are based on a Multilayered Safety strategy (MLS) and it is a long-term procedure which can provide safety and security for the next generations as well. This study includes all the technical and financial characteristics about how to arrange a flood assessment and management. However, there is a significant disadvantage as in the survey there is nothing mentioned about the procedure of the implementation of those elements. This is considered to be a gap in legislation and as well as a weakness (Hooijer et al., 2004).

In the private sector, the coastline of the river surrounded the city of Dordrecht seems to be very attractive for the people that they want to set themselves in this specific part of the region. However, this area is mostly in high risk due to floods in contrast with the inner parts of the territory. In this case, people are willing to get burdened financially for their residence and they are also willing to support economically innovations for flood defense measures. By this attitude, the local people who constitute the private sector in a way the private sector they enforce the measures against flooding (Van Stokkom et al., 2002).

3.10 Conflict prevention and resolution

In this specific domain, the disagreement point between the stakeholders which can be achieved in certain crucial circumstances is of high importance and it should be always avoided by using basic mechanisms. However, the maintenance of equilibrium is not always succeeded that is why sometimes conflicts rise among the different agents concerning the bad effects of a decision taken. That is actually the source of the problem and the crucial moment that the governmental agents should take into account. In order that conflicts can be always avoided, a very clear and strict allocation of responsibilities should be made in advance before a program, a plan or a measurement is getting into practice. In a multi-layer program, the

distribution of duties should be based in the three different principles: ability, Capacity, and Concern (Karlsson, 2007). The three principles are the main attitudes that the governmental mediators should have avoided conflicts. Culpability describes the responsibility that the authorized factors should take in case of a bad effect occurs and it consists a result their own action. Therefore, capacity is the prospect that the agents admit to deal with a problem occurred even if they are not responsible of its creation. Moreover, the concern thinking is a specific prospect that the agents have to realize that their movements and measures taken for a specific case have always an impact to themselves as well. As a result, the correct and clear allocating of responsibilities in different levels and agents is the basic prospect that the agents should follow. In the Dordrecht case, there are not many conflicts occurred as the measures and the plans are following a certain plan. There is efficient allocation of duties to the distinguished agents and very rarely a point of disagreement is reached.

4 Policy Problem assessment

In this part, each building block was assessed based on the introduced criteria in chapter 2. It became clear, that the findings are affected by means of the used literature and its subjective interpretation.

4.1 Water System Knowledge

The water system knowledge level in the context of the expected flood risk on the island of Dordrecht is high and the responsible stakeholders provide a wide-ranging expertise which built a profound knowledge base. In order to mitigate the risk of flooding different calculation and assessment methods were used. However, gaps still remain. Firstly, uncertainties in the prediction reliability of climate scenarios still persist but because of the current state of the art this is inevitable. Secondly, uncertainties about future social, political, demographic, urban planning and economic trends for Dordrecht could be considered more in a long-term perspective within the multi-layer safety strategy. But the parties involved are aware of this gap and require more research and specification (Gersonius et al., 2014). Thirdly, information about flood risk is available (e. g. via internet, campaigns and events). But it is not clear if the access to documents and information increase the awareness of flood risk among the citizen. Whether the central government (or the regional authorities as well as the municipality of Dordrecht) performed studies about the effects of the availability of information on the perception of flood risk or not seemed to be measure that hasn't been realized yet according to the OECD (OECD, 2014). A future challenge will be filling the knowledge gap about the effects of the 'smart combination' measures on the water system and eco-system. To sum up, the knowledge level of the first layer of the MLS policy is high. But the level of the second and third level is low. Gaps occur in the context of the order in which measures should be realized and what effects these measures have on water quality, quantity

or the environment. It is still not clear how to determine the safety levels of the measures in the second and third layer while waving strengthening the height of the dike. In this context, the MLS don't regulate the responsibility for financing and implementing second and third layer measures (Gersonius et al., 2014).

4.2 Values, Principles and Policy Discourse

There seems to be a partly knowledge of shared conflicting values and principles. In the Delta Programme 2015 some of them were outlined and consistency is aimed by the central government and the regional water authorities. Firstly, the strongly trust by the citizen in the government's ability could lead to lower level of awareness as expected. Despite the campaign efforts by government and municipality information about the effectiveness is still not evaluated; but could affect the risk assessment in the multi-layer safety strategy (OECD, 2014). A large problem is the conflicting subsidiarity and decentralization principle and the equity and solidarity principles. Firstly, the decentralization and subsidiarity principles limit municipalities in their power and authority. Secondly, in combination with the equity and solidarity principles citizens living outside first flood defence structures don't have access to protection measures and compensation after a flood although they pay taxes as well. A change of the distinction between areas inside and outside the first flood defence structures is maintained in the multi-layer safety approach. Neither is this topic taken up in the multi-layer safety discourse nor are solutions provided. Recently, the debate has started on national level initiated by the Dutch Delta Programme.

4.3 Stakeholder Involvement

The width and depth of stakeholder involvement on a national scale is high. Especially, the Delta Programme provides a platform for knowledge sharing and discussions about flood protection concerns and improvements of the policy which are considered in the recommendations for the central government. The municipality of Dordrecht participates in the Delta Programme but it is hard to say if their interest and concerns are considered. On the local scale, the municipality commits to a participative approach and aims for a strong co-operation on the one hand with the regional water authority and other relevant stakeholders (e. g. knowledge institutions, private sector). On the other hand the citizens are involved to increase awareness and mitigate flood risk. But it seems that the demand for more participation in the decision-making process among the citizens is relatively low. This could relate with the strong level of trust in the government's flood protection performance ability and the in part 4.2 introduced questions about effectiveness. However, involvement of the private sector is still missing. Thereby, an involvement might lead to better implementation of protections measures and funding. Here too, there is little evidence in the multi-layer safety approach. On the other hand private stakeholders stimulate innovation so that in the end the flood protection efficiency could be improved. But

private parties could provide opportunities in implementation of measures and funding because they provide knowledge and experience (Ministry of Infrastructure and Environment & Ministry of Economic Affairs, 2014).

4.4 Trade-offs between social objectives

As mentioned in chapter 3.4, different trade-offs could arise in the case of Dordrecht. For instance, conflicting objectives could be the dike improvement which is necessary to limit economic loss, damage and casualties. Especially, the current and future state of the dike part that runs through the old city centrum and port area inherits a high conflictual potential. On the one hand this dike-stretch doesn't comply with the safety standards; on the other hand reinforcement will be problematic and affect the tourism branch and its perception as cultural heritage.

In the same context, the parts outside the dike-ring which are not protected by law hold a high conflictual potential. On the one hand damage on the buildings and companies behind the dike-ring will be compensated in the case of flooding. But a big part of the economic value is earned in that part through shipping and tourism. In the case of flooding the economic loss is significant. On the other hand in the risk of casualties and economic loss is high in the new urban area Stadswerven which is located outside of the dike as well if not any protection measures were realized.

4.5 Responsibility, Authority and Means

Under Dutch law, *'residents and users are responsible for taking consequence-reducing measures when there is an unacceptable flood risk'*. As a result, responsibility is on the shoulders of the municipality of Dordrecht and the water board. In theory, local water system knowledge could be insufficient to deal with existing threats. This problem could be solved however by involving non-local knowledge sources, e.g. experts from other regions. On the matter of property rights, home owners are not legally obliged to participate in any way to legislative measures like multi-layer safety. In a 'liberal' (open to debate) country like the Netherlands, cost-reducing measures like adaptations to ground floors, houses and other buildings of a residential nature can in no manner be legally obliged to undergo whichever form of adaptation: the government cannot be an 'aggressor'.

The third layer (safety measures) cannot fully be handled by the municipality of Dordrecht, but should be considered in a regional way. Disaster management, for instance evacuation, is better tackled in GRIP-measures (Coordinated Regional Incident Procedures). This requires the connecting of a myriad of stakeholders, safety services and other entities.

4.6 Regulations and Agreements

Multi-layer safety does not offer ‘the right mix of public and private instruments for the objects at stake,’ the private sector is widely disregarded and not sufficiently incorporated in the process. Furthermore, since multi-layer safety is a largely theoretical toolbox, ‘enforceability’ and ‘effectiveness’ have yet to be proven. The achievement of intended goals, primarily cost effectiveness, cannot be fully guaranteed

4.7 Financial arrangements

The implementation costs of multi-layer safety are split among multiple governmental institutions. The municipality of Dordrecht and the water board Hollandse Delta have issued out budget estimates up until 2015. For outsiders, judgment on whether the allocated financial means are sufficient is difficult – especially with the ‘netherlands must become tenfold safer’ mantra in mind. Aside from that, 2015 is currently nearing its third quarter and no new budget allotments for the coming years are present. It would be wise to think and act more medium to long term, and plan the budgets forward to 2015 or beyond.

The success of multi-layer safety is large dependent on costs vs. benefit: if the costs exceed the implementation costs MLS fails to achieve its objectives. Therefore, careful financial monitoring is essential. Quantifying flood risk (risk, not the effects) requires a difficult hypothetical approach.

4.8 Engineering and Monitoring

The protection infrastructure located in the region of Dordrecht and the enforced legislation on it, are considered not to be absolutely sufficient for the best defense of the city against flooding. There is space for improvement in specific domains. Firstly, on the island of Dordrecht there are the “unbanked areas”, which are places of considerably high altitude that cannot be secured under the present manufactures in a case of extra flooding phenomena (Gersonius et al., 2012). In this case, extra measures should be taken in order to ameliorate the present circumstances. The law should take into account to enforce financially or legally the further development of the protection measures. Secondly, according to the future scenarios of the climate change the current measures are able to provide security until the 2050 (van den Hurk et al., 2007). In the long-term future and after the year of 2050, there has been no research and no future plans. In this case, there is room for further development and research. Furthermore, there is struggling in determining the frequency of flooding; as a result, improvements and further development should take place in the domain of research. Last but not least, there is a battle between the legislation and its social acceptance from the local inhabitants. Specifically, the center of the city is

recognized by its unique historical atmosphere, which is sometimes threatened by the measurements and the infrastructure occurred against the flooding. The government and the authorities should take into account the level of the measures provided by the local community. The legislation makers should be aware of the importance of the maintenance of this historical heritage of the city and combine it with the importance of the security against flooding. A balance should occur so as both goals to be achieved.

4.9 Enforcement

In the Netherlands, all the public and private factors are very well organized and provide sufficient knowledge and measures against the problems occurred. However, despite the abundance of knowledge there is lack of the implementation methods of what is already decided by the local authorities. Specifically, in the case of Dordrecht, there is a defense program against flooding which has been constructed by the National Waterplan (Rijksoverheid, 2009). This plan is approaching a Multilayered Safety strategy, which can be efficient in the case of Dordrecht now and for the long term, as well. In this specific program, despite the fact that everything has been scheduled and organized concerning the financial and technical characteristics, nothing has been mentioned about the practical application of the methods and the mechanisms for better implementation (Becker et al., 2007). That means that the operators which are in charge of the implementation of the measurements do not know do not have totally specified responsibilities and clear techniques of how they should be achieved. In this domain, there is room for further development and amelioration. One plan constructed in order to deal with a local problem occurred; it should contain all the necessary characteristics about the technical, financial and administrative characteristics.

4.10 Conflict prevention and resolution

The European and the national law are efficient  as conflicts will be almost always avoidable. Every governmental agent has a specific role that it has to follow and respect so as to fulfill what it is required within its certain field of jurisdiction. However, in this domain there is room for further improvement. In the specific case of the Dordrecht Island and the multi-layer safety approach, there is not a clear and totally specific declaration of the distribution of duties to the distinguished agents (Becker et al., 2007). This is the first and basic step so as to create a clear allocation in distribution of duties and avoid to maximum the possibility of occurring conflicts. As a result, the Multi-Layer Safety plan should be more precise and detailed on the allocation of responsibilities among the agents.

5 Discussion

The Multi-layer safety approach is the basic legislation used in the Dordrecht case in order to mitigate its flooding phenomena. This policy was assessed under three elementary categories: content, organization and implementation; as we have already mentioned. Having estimated the content in those categories we reached the point to conclude that some elementary problems appeared and multiple improvements are required. In the following the advantages and gaps of the MLS will be discussed while giving recommendations for improvement.

As positive to evaluate is that the Multi-layer safety policy incorporates a risk based approach. This means a shift in thinking about water safety and flood management is taking place. And in more holistic respect the MLS policy can be seen as an integrative approach to climate change adaptation. Using it in a proper way, innovation could be stimulated, awareness increased and casualties, economic loss as well as damage mitigated. This could avoid a lot of compensation costs.

Therefore, MLS has a solid theoretical background; however, there is room for improvement in the practical part and barriers for further improvement. In general, overcoming the old mentalities about flood protection and management is still a challenge. Dordrecht heavily invested in dike strengthening in last decades and for a long time it was the best possible way. But improving the first flood defence dike ring became increasingly difficult and costly, especially because of the fact that the dike runs through the city. During the assessment it became clear that gaps of the MLS in the content and organizational part highly affected the limitations in the implementation. Therefore, having a high knowledge level about the water system, conflicting values and principles and trade-offs under the premise that a large range of stakeholders are involved and it is clear who is responsible for what, becomes even more important. The “unembanked areas” are under high significance and extra measures should be taken into account; while in the same time the historical atmosphere of the city center should be beyond any kind of anti-flooding infrastructure. Dordrecht should do their utmost to push the debate about a rethinking of the distinction of areas inside and outside the dike further, especially in legal terms. Considering all stakeholders also mean the involvement of the private sector which can provide financial support, know-how in implementation and stimulate innovation. In Dordrecht’s Waterplan is such a commitment given but not to what extent the municipality seeks to co-operate with the private sector. However, communication is important and can raise awareness.

In the organizational part of the assessment the main barrier of a lack of legal obligations could be identified. Neither for the MLS as policy nor for the sustainable spatial planning and crisis management in the context of flood safety are legal standards available. The development of legal standards should base on the probability of casualties and damage instead of flood frequency. Thereby, the water Board and the Municipality of Dordrecht are the main agents who should implement

successfully and satisfactory a legislation against flooding. In this domain, the MLS program should treat equally the private and public domain so as the cooperation of those two sectors can contribute to the best result. GRIP-measures are considered to be more efficient than the MLS program as all the stakeholders are combined equally and have the right to contribute to any alterations of the legislation.

In the case of enforcement, a main gap is that in the MLS program despite the fact that everything is mentioned about the financial and technical characteristics of the plan, there is no claim on the allocation of duties among the governmental agents. Especially information about the financiers of investments in measures of the second and third level is still missing. This is of high importance as the not clear classification of duties offers space for conflicts among the potentially responsible agents and contributed to the low efficiency of the MLS program.

The aim of this paper was to assess the MLS in order to find out if it is feasible and useful for Dordrecht challenging flood risk. The answer is: no. The current state of the MLS has more gaps, limitations and barriers as Dordrecht can benefit from the implementation. Indeed the case of Dordrecht is complex and the spatial conditions of the island are complicated. An integrative risk-based policy is even more necessary. The MLS policy could provide such an approach if improvement could be achieved. But that takes time; especially the MLS policy is still in its infancy and only a few years ago presented. A creation of a network with other cities which also implemented the MLS policy could facilitate the improvement process by means of knowledge exchange.

6 Conclusion

The Netherlands constitutes a great example to other nations as it serves as a “pioneer” by promoting new knowledge and its implementation in many domains. One such example is also the case of Dordrecht and the Multi-layer safety programme against flooding issues. The different scales of protection are a great innovation in the defense level against natural phenomena by describing in detail all the financial and technical characteristics for its success. However, the independent action of the governmental agents which is a basic characteristic of the Dutch territory sometimes leaves the impression of further requirements concerning the allocation of duties and responsibilities to the distinguished actors; while in the same time there is a proof that the research and knowledge on a field never ends and there is always necessity of amelioration. The Multi-layer safety is the evidence of the Dutch innovation skeptics, and by ameliorations taken place throughout time can be a great and absolute efficient example against undesirable natural occurrences.

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