

**Directorate-General of Public Works
and Water Management -**

**National Institute for Coastal and
Marine Management/RIKZ**

**COMRISK
Subproject 1**

**Evaluation of policies and
strategies for coastal risk
management**

– Final report –



Amstelveen, The Netherlands
December 2004



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Management summary

i. Introduction

Background

40,000 square kilometres in the southern North Sea Region could be potentially affected by flooding. 14 million people live and work in this area and governments are involved in managing this risk. Their actions and their objectives, however, have differences as well as similarities.

On behalf of the Dutch National Institute for Coastal and Marine Management (RIKZ), a consortium composed of KPMG Strategy Economics, Atos KPMG Consulting and TU Delft has carried out subproject 1: “Policies and strategies for coastal risk management” as part of the “Common Strategies to Reduce the Risks of Storm Floods in Coastal Lowlands” (COMRISK) North Sea Interreg project.

Research objectives

The following objectives have been defined:

- To provide a comprehensive analytical framework as a tool to properly assess policies and strategies;
- To make an inventory of different levels (strategic, institutional, instrumental and operational) of coastal risk management in relation to the current national policies of the countries and regions in the North Sea Region involved in the COMRISK project;¹
- To make an assessment of current national policies in terms of legal, social, technical, financial, socio-economic, ecological and managerial aspects (including the ICZM (Integrated Coastal Zone Management) principles for sustainability).

Structure of this management summary

This management summary is structured as follows:

- Section ii provides the main conclusions and recommendations;
- Section iii describes the applied methodology;
- Section iv provides the main results regarding policy context;
- Section v provides the main results regarding policies and strategies.

ii. Conclusions and recommendations

Main conclusion: Strong relation between context and policy

The relation between context and policy has been extensively discussed with the interviewees and the members of the COMRISK project team. Although the relation between context and policy is hard to quantify, policy seems to be largely dependent on context elements such as flooding history, the cultural, socio-economic and institutional setting, public awareness, et cetera. At the same time this does not necessarily mean that policy cannot be influenced or changed.

This brings us to the conclusion that, within each country or region, specific context policy-makers have a certain degree of policy freedom. This degree of freedom depends on several factors such as the available mandate or authority, the current political agenda, the need for change, the budget available, public support in general and other issues.

This also implies that countries and regions can learn from each other. We have found several differences between the countries and regions. We have, for instance, seen that there is a greater difference in applied measures in England and Denmark than there is in the Netherlands, Germany and Flanders. This offers opportunities and challenges to exchange experiences and information and/or to adopt part of each others' policies, strategies, measures and/or instruments within the country-specific context.

Should we examine the major differences between the regions, issues that are particularly interesting for this purpose are, for example, public awareness in relation to the responsibility to act (government versus individuals taking action), insurance versus compensation, evacuation and crisis management.

Recommendations

The objective of COMRISK is to improve coastal flood risk management through the transfer and evaluation of knowledge and methods as well as pilot studies. The subproject currently being discussed has provided a comprehensive analytic framework as a tool to assess policies and strategies for the five regions. The analytic framework has proven to be an adequate tool for gaining insight into coastal risk management in the North Sea Region. It is used to assess current national policies in terms of legal, social, technical, financial, socio-economic, ecological and managerial aspects. The framework can also benefit future policy analysis.

This COMRISK subproject contributed in assessing and comparing current policies and strategies. We are convinced that the countries already benefited from this study by sharing information, experiences and by contributing to several discussions. Nevertheless, several authorities and key players have expressed their desire to learn more from each other and possibly adopt each others' instruments or even achieve common strategies. Although we could argue that serious difficulties will be involved in establishing common strategies for

coastal flood risk management, we conclude that defining common policies and strategies is a major challenge and opportunity for improved coastal flood risk management.

Policies and strategies can be defined by:

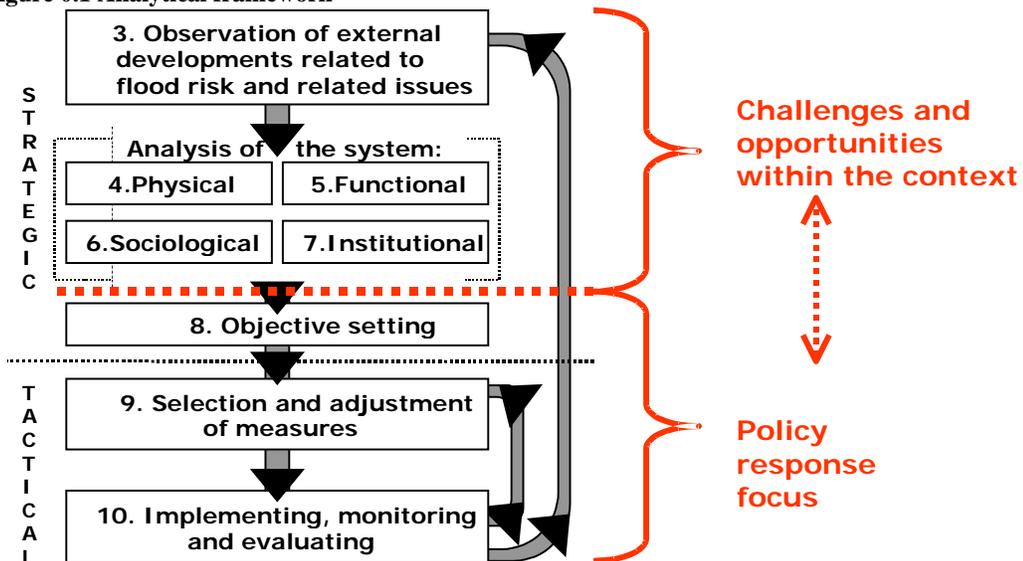
- Establishing a partnership which stimulates knowledge exchange between the countries and regions regarding the themes mentioned above. The current North Sea Coastal Managers Group could perform this activity.
- Developing strategy, where deemed desirable, by partnering on specific strategies and measures. This is especially relevant in relation to the following areas: public awareness in relation to responsibility of acting (government versus individuals taking action), insurance versus compensation, evacuation and crisis management;

Defining common strategies and policies does not necessarily have to lead to harmonisation. Although future harmonisation of policies and strategies should not be avoided when desirable and feasible, we believe that policy-makers should focus on further mutual understanding and learning.

iii. Methodology applied

The strategies and policies of the countries and regions involved have been inventoried and assessed within the project context. Sound methodology is needed to ensure proper assessment of policies and strategies. A methodology has, therefore, been defined in the form of an analytical framework for looking at coastal flood risk management policies.

Figure 0.1 Analytical framework



A distinction between the *context* and *policy* has been made within the framework. Within the context elements are present that are important to the governments of the different regions. The government has to act within this context and may not directly influence the context. Choices are made in the *policy* elements including the setting of objectives (a strategic element).

Assessing the context: challenges

When assessing the context, the subproject team analysed which challenges policy-makers face. We believe that challenges can be threats that should either be confronted or avoided but also opportunities to be explored and possibly developed further.

Assessing the policy: focus

Depending on its socio-economic and socio-cultural settings, the form in which coastal risk management is implemented will probably be very different. For this reason we have refrained from taking one country or region as “best practice” or to speak of *the* best coastal risk management process since it will differ from country to country to ensure it fits within its own context.

We can, however, specify the areas focused on within a policy. The ICZM criteria as formulated by the European Commission (EU ICZM) have been used for this purpose. These principles provide various methods that can result in good coastal zone management.

Assessing the policy: adapting the ICZM principles

The EU-ICZM principles, however, have been formulated at quite a high and abstract level. They, furthermore, relate to both the institutional structure and to the policy related to coastal management. The ICZM principles have been made more concrete for this project in order to be used as criteria in assessing policies.

Assessment within the analytic framework

The results of the assessments are shown at the end of each section. The challenges and focuses haven been indicated with dots. A large dot specifies a major challenge/focus and a smaller dot specifies a challenge/focus that is significant. Two remarks need to be made in this respect:

- Although the subproject team has made every effort to carefully identify the challenges, there always will be room for discussion with regard to details;
- We can argue for both concentration and a broad, comprehensive approach in policy. More and larger dots do not necessarily equal better policy.

iv. Results on policy context

External developments

The three identified significant external developments are shown in figure 0.2. All countries and regions regard climate change and the corresponding sea level rise as a major challenge. Ecological provisions (for example: the Birds and Habitat directives) are a factor that makes policy-making more complicated but in most cases not regarded to be a major challenge to existing policy. Development pressure is a major issue for the Netherlands and England.

Figure 0.2 Challenges from external developments

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Relative sea level rise	●	●	●	●	●	●	●
Ecological regulation	●	●	●	●	●	●	●
Pressure for development	●	●	●		●		

● Major challenge ● Challenge

Coastal system: physics

The following may be concluded in relation to the physical system and the sea which may flood over or break through the coastal defences leading to flooding of the inland areas. The German coastline offers the least natural protection. The Dutch physical context, however, is most challenging both in absolute and relative terms although it has some protective dunes.

Figure 0.3 Physical opportunities and threats

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Large amount of flood prone area	●	●	●	●	●	●	
Deep flood prone areas	●	●	●	●	●	●	
Natural coastline offers little protection	●		●	●	-	●	●

● Major challenge ● Challenge

The functions of the coast and flood prone inland areas

Which economic and other functions are present in the respective areas? Where are the conflicts? In the Netherlands, major cities are situated entirely in flood prone areas. Hamburg and London are partly situated in potential flood prone areas. Almost all policy-makers are confronted with sensitive natural habitats on their coastlines, which represent restrictions and conditions to coastal defences.

Figure 0.4 Challenges from the socio-economic functions

	England	Flanders	Nether-lands	Nieder-Sachsen	Hamburg	Schlesw. Holstein	Denmark
Major cities threatened	●		●		●		
Designated nature areas	●	●	●	●		●	●

● Major challenge ● Challenge

Societal perceptions and attitudes towards flooding

The common challenge policy-makers have to face in England, Flanders, the Netherlands and, to a lesser extent, Niedersachsen is how to convince (some of) their citizens of the urgency the current situation represents and how to either gain their support with regard to governmental action or to ensure they take action themselves. Research has shown that citizens of Schleswig-Holstein do not seem to be aware of the risk but this has not lead to practical difficulties in implementing policy. In general, policy-makers in Hamburg and Denmark feel that the demand and support for action is about right. .

Figure 0.5 Challenges due to societal perceptions

	England	Flanders	Nether-lands	Nieder-sachsen	Hamburg	Schlesw. Holstein	Denmark
Low sense of urgency among citizens	●	●	●	●		*	

● Major challenge ● Challenge

**) Limited awareness but not regarded as a problem.*

Institutional context

Limited staff capacity is a common challenge for policy-makers in all countries and regions. The challenges regarding integration of policy fields and levels of government are more ambiguous. The links are not strong in relation to some policy fields but often the primary policy-makers do not consider this as a major problem. The vertical integration in England has improved according to all interviewees. At a local level, however, a "national policy vacuum" is being experienced.

Figure 0.6 Challenges from the institutional context

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Limited staff capacity		●					
Limited budget	●	●	●	●	●	●	●
Limited relation to disaster management policy		●	*				
Limited relation to spatial plan policy		●	●				
Limited vertical integration.	**		●				

*) *The relation is limited but is not regarded as a problem.*

***) *There is a policy vacuum according to the local level.*

● Major challenge ● Challenge

v. Results on policies and strategies

Risk assessment and objective setting

England and the Netherlands have a multigenerational time horizon in common. Both countries explore the long-term demands for coastal protection. The other countries and regions generally have limited themselves to studying how the current level of protection could be maintained in the long-term.

England has a strong focus on calculating costs and benefits since a benefit-cost ratio is calculated for every project. In the Netherlands and Denmark, current standards were set decades ago with much consideration given to costs and benefits. Standards are currently being updated.

Hamburg and Niedersachsen (in the Weser-Ems region) have quantified potential dangers to a certain degree. Since legislation, however, prescribes that every German citizen should have the same protection level, the dyke design regulation does not distinguish between protection levels and so this aspect cannot be directly incorporated in the decision-making

process. Schleswig-Holstein has incorporated this type of information by defining priorities in relation to implementation.

The way in which the ecological carrying capacity is taken into account is quite similar in most respects since EU law regulates matters such as environmental impact assessments and the protection of habitats.

Figure 0.7 Objective setting focus

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Taking into account the needs of many generations	●		●				
Economic costs and benefits taken into account	●		●			●	●
Ecological carrying capacity taken into account	●	●	●	●	●	●	●

● High focus level ● Moderate focus level

Selection of measures

The potential areas that are focused on in relation to measures have been derived from the ICZM criteria. They also relate to the organisation of flood risk management in some respects.

The allowance made for coastal dynamics is very much connected to erosion policy, which is outside the scope of this study. England largely makes allowances for dynamics and also includes setting back of dyke lines. A certain degree of dynamics is allowed in Flanders, the Netherlands, Niedersachsen (the Islands) and Denmark although, in general, the areas that are now being protected will continue to be protected. In exceptional cases, a retreat policy for the mainland may be followed in Germany.

The Niedersachsen high-level policy is most strictly prescribing and local policy-making freedom is limited. Schleswig-Holstein high-level policy-makers have given the water boards the necessary freedom with regard to secondary dykes. Hamburg is itself an almost local authority and allows industry to arrange its own protection.

Denmark places much emphasis on the initiative and freedom of the counties and boards. Standards are set at a central level in the Netherlands and Flanders. Locally tailored-made solutions, however, is receiving more and more attention. Alternatives to reach safety standards are discussed with local communities and municipalities.

England, Denmark and, to a slightly lesser extent, Hamburg use a variety of measures to achieve their objectives: allowing dynamics, forecast and warning, evacuation and coastal defence. Flanders, the Netherlands and the other German states concentrate on coastal defence.

The Netherlands is also searching more and more often for multiple solutions to implement coastal defences although still mainly focused on coastal defence.

Figure 0.8 Areas focused on in relation to implemented measures

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Allowing dynamics	●	●	●				●
Allowance of local tailor-made solutions	●	●	●		●		●
Variety of measures	●				●		●
Variety of methods to achieve measures	●		●		●		●

● High focus level ● Moderate focus level

Implementing, monitoring and evaluating

All countries and regions try to improve their actions by learning about their performance. Only, however, a few regions are actually reconsidering their general set of measures or have done so recently.

Figure 0.9 Areas focused on in relation to monitoring and evaluating

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Performance monitoring of measures	●	●	●	●	●	●	●
Reconsideration at strategic level	●	●	●				

● High focus level ● Moderate focus level

¹ The countries and regions we have studied include England (UK), Flanders (Belgium), Bremen, Niedersachsen, Hamburg, Schleswig-Holstein (Germany), Denmark and the Netherlands.

Part A Introduction

1 Background and research objective

The subject of this report will be introduced in this section. The research context and objectives will also be further discussed. The methodology used for achieving the research objective will be explained in the following section.

1.1 Flood risk management in the North Sea Region

Throughout history, numerous storm floods have struck the countries and regions around the North Sea. Although for decades no major disaster has happened, the risk is ever present. Up to 40,000 square kilometres, in which 14 million people live and work, are potentially affected. The hazard may very well be increasing due to ongoing climate change.

Throughout history, citizens and their governments have tried to manage the risk of flooding. Their methods vary in time and place from dyke building to encouraging insurance cover for flood events and from zoning regulation to evacuation planning. The objectives served by these methods are not static either. Trade-offs made between economy, safety and environment differ in time and place.

In recent years, the ambition of having integrated coastal zone management (ICZM) is becoming increasingly important when managing risk. Policy-makers try to consider as many long-term aspects as possible. Another emerging trend is that of cooperation and mutual learning within the European Union. The North Sea Coastal Managers Group (NSCMG) is an important platform for such activities within the North Sea Region. This group has been responsible for initiating the COMRISK project.

1.2 The COMRISK project

The “Common Strategies to Reduce the Risks of Storm Floods in Coastal Lowlands” project of the NSCMG aims at improved coastal flood risk management through a transfer and evaluation of knowledge and methods as well as pilot studies.

The COMRISK project consists of an “umbrella project” and a number of closely connected subprojects. The “Policies and strategies for coastal risk management” subproject 1 has been set up to contribute to the improvement of risk management by means of inventorying and evaluating national policies and strategies in terms of sustainability.

The National Institute for Coastal and Marine Management (RIKZ)² is the responsible partner within COMRISK for subproject 1 (referred to as “the subproject” or “the study” from this point on). The contractor of this subproject is a consortium that consists of KPMG Strategy Economics (KPMG BEA), Atos KPMG Consulting and Delft University of Technology (TU Delft). This consortium will be further referred to as the subproject team.

1.3 Objectives

The COMRISK subproject team has identified the following objectives in relation to the subproject:

- To provide a comprehensive analytical framework as a tool to properly assess the policies and strategies;
- To provide an inventory of different levels (strategic, institutional, instrumental and operational) of coastal risk management in present national policies of the 5 countries in the North Sea Region involved in the COMRISK project;
- To provide an assessment of the present national policies in terms of legal, social, technical, financial, socio-economic, ecological and managerial aspects (including the ICZM principles for sustainability).

Relation to other COMRISK subprojects

The COMRISK project consists of a number of subprojects that are executed in parallel. Subproject 1 focuses on the policy level in the present situation (including trends); developing new methods is not an aim.

The other subprojects are important information sources for this project and vice versa. Information on specific aspects of the policies researched in other subprojects has been incorporated in this subproject as much as possible. This has mainly been done through participation in workshops organised for the other subprojects.

1.4 The contents of this report

The analytical framework will be further discussed in the next section. The results of the inventory and assessment will be presented in parts B and C. Part B discusses policy environment, part C deals with the policy itself and the final part, D, is a synthesis of parts B and C. It contains the main findings and recommendations. The annex contains a list of documents and a list of interviewees consulted within the context of the project.

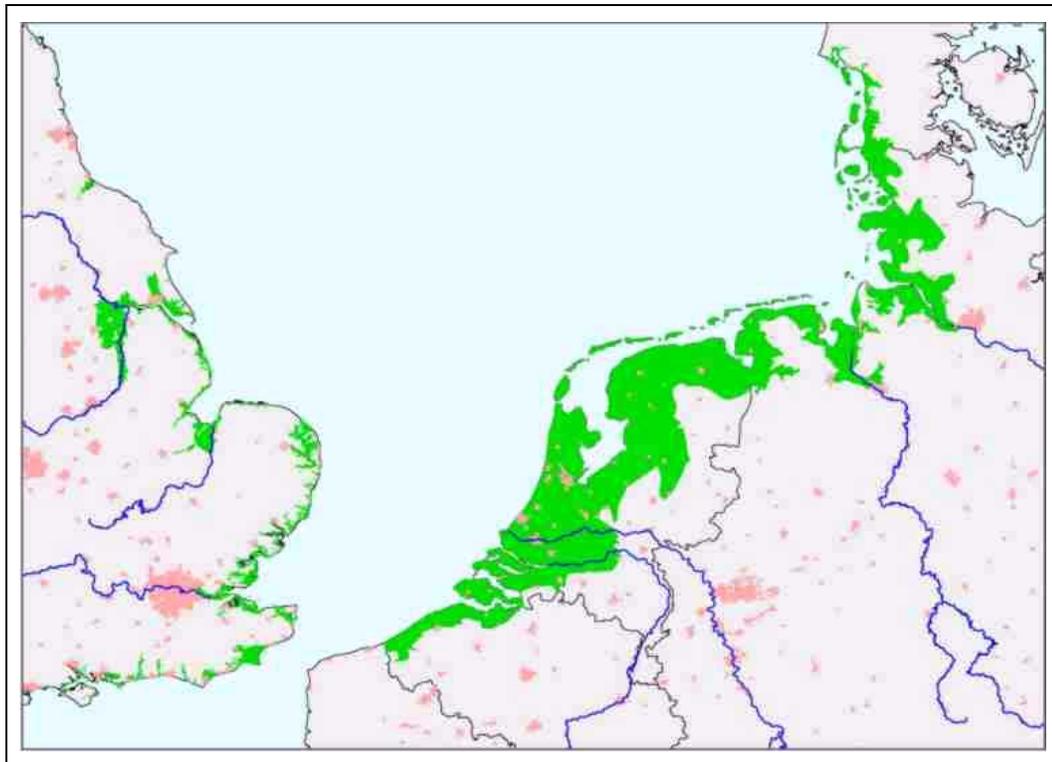
² RIKZ forms part of the Directorate-General for Public Works and Water Management (Rijkswaterstaat) of the Dutch Ministry of Transport, Public Works and Water Management.

2 Methodology

Firstly, the scope of the project is defined in this section (2.1) followed by the presentation of an analytical framework for looking at coastal flood risk management policies (2.2). Finally, the methodology of the assessment phase is described.

2.1 Scope of the study

Figure 2.1 Geographical scope of the study (taken from www.comrisk.org)



Geographical boundaries of the study

The geographical scope of this study is the southern North Sea Region, including England (UK), Flanders (Belgium), Netherlands, Niedersachsen, Schleswig-Holstein, Hamburg, Bremen (Germany) and Denmark. France is outside of the scope of the research. Although the German city states do not participate in the COMRISK project, their policies have been studied. Because of the limited size of Bremen and the similarity of their policies to those used by Niedersachsen, this city will not be listed in all overview tables.

Figure 2.1 depicts the geographical scope, which is the coastline³ and flood prone inland area (in green)⁴. As there is not one single, unambiguous definition of “flood prone”, a clear-cut

land-inward demarcation of the research area is not possible. This will be further discussed in section 4.

Mainly policies between countries (or regions) at a national level have been compared but all levels of government that are relevant for the coast and their policies have been taken into account.

2.2 Framework for analysing coastal flood risk management

The strategies and policies of the countries/regions involved have been inventoried and assessed within the scope of the project. The two key points of attention for this study are the following to ensure that policies are “fairly” compared:

- The process and motivation behind the policy: Why are certain policies chosen? What objectives do the policies serve?
- The context of the policy: What are the differences between the countries in relation to the policy environment?

The framework is presented in Figure 2.2. The steps are an elaboration of the steps identified in coastal flood risk management (see the frame). Two cycles can be identified: a strategic cycle and a tactical cycle⁵.

Strategic cycle

Risk factors and coastal systems are analysed and (high-level) objectives are set in the *strategic cycle*. Typical questions the policy-makers ask themselves in this cycle are “What is the order of magnitude of the current and future risk? Is this acceptable to us?” and “which criteria should a good policy meet?” A distinction is made between the following elements within this cycle:

- *Observation of external developments*: Often a reconsideration of a policy is triggered by the observation of an external development. The increasing inflow of people into the coastal zone or the size of the built-up area may, for instance, trigger a demand for higher protection levels.
- *Analysis of the present system*: A step a policy-maker may next take is to analyse what these developments will mean for the coastal system and whether the present system can cope with such developments or not. The policy-maker will ask himself or herself

What is meant by coastal flood risk management?

The concept of coastal flood risk management has been derived from safety science theory (refer i.e. to Kirwan, Hale and Hopkins (2002)).

Risk is a combination of the probability (or frequency) of occurrence of a defined hazard and the magnitude of the consequences of the occurrence. It is not necessarily a number.

Risk management is the process of implementing decisions about accepting or altering risk, based on an assessment of various costs and benefits. This also implies decisions about acceptable risk levels and appropriate measures.

In applying risk management to the field of *coastal flood risk management* the following steps have been identified:

- Identification of the nature and extent of flood risks;
- Understanding and addressing the relevant public perceptions;
- Establishing goals and standards with respect to the flood risk;
- Establishing strategies and policies to achieve these goals;
- Finally minimizing the costs of achieving the goals, whilst ensuring the risk remains acceptable.

questions such as: “How frequent will an area be flooded and what would be the consequences?”

This report will look into four aspects of such analyses: the physical aspects, the functional aspects (which functions are present in the coastal zone and flood prone inland areas), sociological aspects (what are the perceptions and attitudes of society) and institutional aspects (which public structures are present).

- *Risk assessment and objective setting:* More subjective choices have to be made after analysis. Is the risk acceptable or not? If so, how urgent is the need for risk reduction? What other interests are at stake? These are the demands (criteria) that will influence the choice of good policy instruments. These instruments are selected in the tactical cycle.

Tactical cycle

Instruments are chosen on their ability to achieve the set objectives of the strategic cycle in the *tactical cycle*. Instruments are regarded as possibilities to influence the coastal systems.

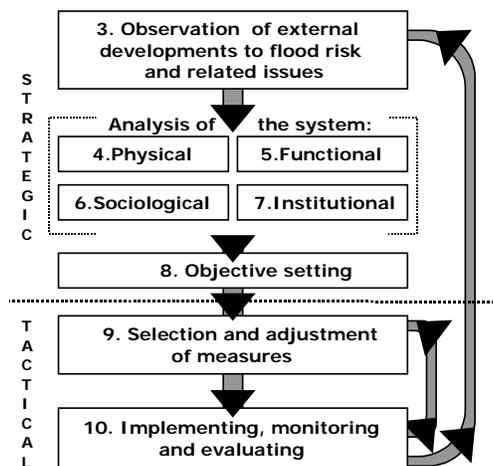
Typical questions the policy-makers will ask themselves are: “Is it better to prevent damage or to compensate damage afterwards?”, “Should there be investments in dykes or warning systems?” After some experience with chosen instruments, lessons will be learned and adjustments will be made. New insights will, for instance, change the design of dykes or an awareness raising campaign will be launched to raise support.

Sometimes, however, the experience gained from the instruments will lead to reconsiderations at a strategic level. This could happen after a disaster occurs or if it is agreed that the set objectives cannot be reached at all at, for instance, the current available budget.

We will make a distinction between the following phases:

- *Selection of risk management measures.* Measures are chosen in relation to the objectives. This is the pivotal point where the policies are formulated. Typical questions a policy-maker asks himself or herself in this phase are “Should I build dykes or opt for insurance schemes?” and “How can I convince people they need insurance?”
- *Implementing, monitoring and evaluating.* As the policy is already formulated, we will only briefly look at the next phases and their meaning to the choice of instruments and input for new strategic cycles.

Figure 2.2 Analytical framework



Limitations to models...

Our model is meant to provide structure to the information on coastal flood risk policy and policy-making and to compare countries and regions. The reality, however, is always more complex and fuzzy than a management model. Iterations take place between all phases. The arrows just depict the most important. This model should by no means be assumed to be a prototype for flood risk management.

2.3 Methodology of the inventory

The inventory consists of filling-in all the elements of the framework for the countries/regions involved. Attention is paid to both the methods and the outcome of each of the elements.

Information needs

The subproject team has identified the information needed for this subproject based on the analytical framework. These needs lead to questions at the levels that are comparable to those identified in paragraph 1.3:

- *At the physical level:* What are important coast characteristics? What are important characteristics of the flood prone inland areas? What are main developments and trends that influence the coast?
- *At the functional (socio-economic) level:* What are the main functions of the coasts and their respective inland areas? To which extent are they at risk from flooding? Which trends are there?
- *At the sociological level (societal perception and attitude):* Which risk do the societies of the regions/countries perceive? Do they demand a reduction? What other related demands do they make? Which trends are there?
- *At the institutional level:* Which organisations are involved and how do they coordinate their actions? How is public participation organised? Which laws are applicable?
- *At the level of objectives: instrumental-level (both managerial and technical):* What is the general judgement of the risk? What types of objectives have been formulated; what are these?
- *At the level of instruments:* What is main cornerstone of the policy? Which policy instruments (economical, legislation, communication) are being used? What actions do they aim at?
- *At the level of implementing and funding:* How is the policy implemented? How is risk management financed?
- *At the level of monitoring and evaluation:* How is the monitoring organised? What is the outcome of these? Are instruments being reconsidered?

Information sources

For these information needs, information sources have been identified. In the preliminary phase the national policy document and a selection of lower government relevant coastal, flood risk and water management were studied. In addition, earlier cross-country studies into North West European Flood Risk Management and Coastal Management were studied.

In a next phase 25 interviews with coastal flood risk policy-makers and experts have been held to find the motivation behind the policies and to fill specific information gaps.

The results of the inventory will be presented for each element in an overview table, which then will be elaborated on in the assessment. The methodology for this assessment will be presented in the next paragraph.

2.4 Methodology of the assessment

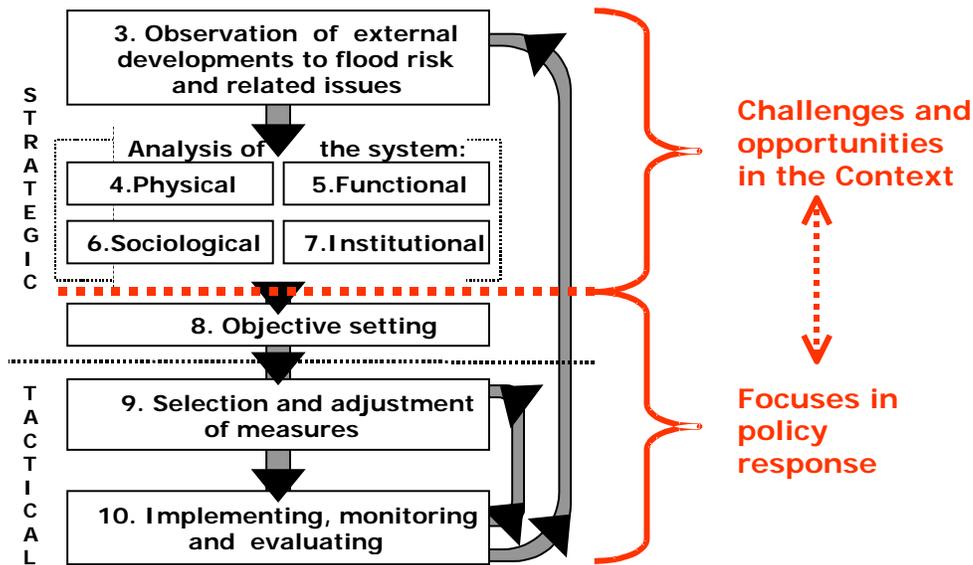
The inventory itself is an interesting product; it enables coastal authorities to compare their policies to that of others.

An assessment of the policies has, however, also been made which is the next step. This assessment consists of a comparison between the context of policy-making and the formulated policy itself. We can, thus, also incorporate differences in context whilst still comparing countries/regions.

Distinction between context and policy

A distinction is made in the inventory phase between the strategic and tactical level. A distinction between the *context* and *policy* is also made in the assessment phase in the framework. This is illustrated in figure 2.3.

Figure 2.3 The analytical framework for assessment (context-policy; the numbers refer to the following sections)



Elements are present on a context level that are important to the respective governments. These governments have to manage within this context and cannot directly influence it. Choices are made in the elements of the *policy* including the setting of objectives (a strategic element).

Assessing the context: challenges

The subproject team analysed which challenges policy-makers face when assessing the context. Challenges can be threats to be confronted or avoided but may also be opportunities to be explored and possibly further developed.

The specific challenges policy-makers have given in the interviews and policy-documents have been recorded for most aspects. The EU ICZM principles (see below) have also been used in relation to institutional aspects.

Assessing the policy: focus

Depending on its socio-economic and socio-cultural setting, the form in which coastal risk management is implemented will probably be very different. For this reason we will refrain from taking one country as “best practice” or to speak of *the* best coastal risk management process as it will differ from country to country to ensure it fits within its own context.

We can, however, indicate what the areas focused on are within a policy. The ICZM criteria as defined by the European Commission (EU ICZM) have been used for this purpose. These principles offer various options for good coastal zone management.

All countries/regions will use these principles to some extent. Certain countries or regions, however, may focus, for instance, on using a variety of instruments whilst other focus on a few specific instruments.

Focusing on more or fewer aspects is a choice that is in itself neither good nor bad: more dots in the overviews do not necessarily mean that countries/regions have made better choices. The final section of this report offers some reflections on this matter.

Assessing policy: adapting the ICZM principles

The EU-ICZM principles, however, have been formulated at quite a high and abstract level. They, furthermore, relate to both the institutional structure and to the policy of coastal management.

Institutional structure is regarded in this report as an element that can only be influenced indirectly (thus, a challenge). Institutional structure is not included in the assessment of the policy but has been used to check whether the institutional structure contains a policy challenge. The remaining ICZM principles have been made more concrete for the purpose of this study. This process is depicted in table 2.1.

Table 2.1 EU-ICZM principles and derived flood risk policy criteria

EU-ICZM principle	Criteria for coastal flood risk management policy (formulated as strengths)	Relevant part of the analytical framework
1. A broad “holistic” perspective (thematic and geographic)	A wide array of functions of the coastline and flood prone inland areas are taken into account	Policy: Risk assessment and objective setting
	Horizontal integration (integration/coordination of themes/departments)	(Context: Institutional context)
2. A long-term perspective (which will take into account the precautionary principle and the needs of present and future generations)	A time horizon and the needs of several generations is taken into account in the policy process	Policy: Risk assessment and objectives
3. Adaptive management during a gradual process	The policies are frequently monitored and evaluated both on a tactical and on a strategic level	Policy: Evaluating and monitoring
4. Reflect local specificity	The instruments used at a higher level allow for local adjustments	Policy: Instruments

5. Work with natural processes (which will make human activities more environmentally-friendly and economically sound in the long run)	The carrying capacity of the environment for flood risk measures is taken into account	Policy: Risk assessment and objectives
	The economic costs and benefits are taken into account	Policy: Risk assessment and objectives
	Allowing coastal dynamics line and profile	Policy: Instruments
6. Participatory planning	Participation of the public and organisations	(Context: Institutional context)
7. Support and involvement of relevant administrative bodies at a national, regional and local level between which appropriate links are set in place with the aim of improving the coordination of various existing policies	Horizontal integration (integration/coordination with other themes/departments)	(Context: Institutional context)
	Vertical integration (integration between levels of government)	(Context: Institutional context)
8. Use of a combination of instruments	A range of management instruments (economic, regulatory, communication) is used to ensure instruments are attained	Policy: Instruments
	The whole range of measures (prevention and compensation) is used	Policy: Instruments

Conclusion: Assessment within the analytic framework

Table 2.2 depicts the resulting assessment method within the elements of the framework. Earlier it has been stated that a single best policy for all countries does not exist.

The results of the assessments are depicted at the end of each section. The challenges and focuses will be specified with dots. A big dot indicates a major challenge/focus and a smaller dot means a significant challenge/focus.

Two remarks need to be made regarding this method:

- Although the subproject team has made every effort to carefully identify the challenges, there always will be room for discussion with regard to details;
- We can argue for both concentration and a broad, comprehensive approach in policy. **More and larger dots do not necessarily equal better policy.**

Table 2.2 Assessment aspects

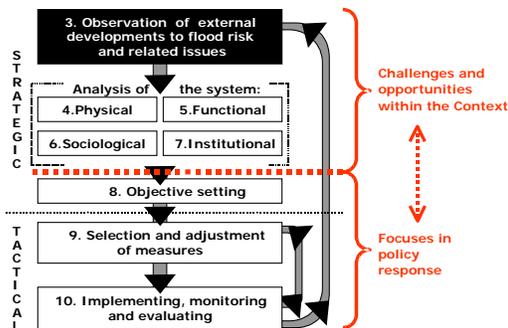
Framework part	Assessment aspects
External developments	(Country-specific) challenges in the coastal system
Coastal system: Physics	
Coastal system: Socio-economics	
Coastal system: Institutional context	<i>Vertical integration</i> <i>Horizontal integration (towards other concerned departments and policy fields)</i> Country-specific challenges
Risk assessment and objective setting	<i>Taking into account all functions of the shoreline and flood prone-areas</i> <i>Taking into account ecological/economic costs and benefits</i>
Selection of instruments	<i>Allowance for dynamics</i> <i>Allowance for local flexibility</i> <i>Whole range of instruments considered</i> <i>Whole range of intervention points considered</i>
Implementing, monitoring and evaluating	<i>Evaluation of policies at a tactical level (adjustment instruments)</i> <i>Evaluation of policies at a strategic level (reconsidering instruments and objectives)</i>

³ The focus in this study has been on the main coastline and interior, the islands have not been focussed upon. The main reason for this, is that the islands constitute only a fraction of the flood prone areas in the North Sea Region (about 1-2% of all land in the study area below +5 metre MSL is situated in islands, see chapter 4 for details on measurement method).

⁴ Note that the green area corresponds – roughly – to the areas prone to coastal flooding under the definition of the individual policy-makers. In many parts of these reports, we will zoom in to the level of states within federal systems. These state boundaries are not shown in this figure.

⁵ This model is an application of a more general management model of KPMG. The cycles have some similarities with the model sometimes used by Rijkswaterstaat (Dutch Directorate-General for Public Works and Water Management) although it should be stressed they are not the same.

Part B The Context



3 External developments

Owing to the cyclic nature of the policy process, no formal starting point exists. We will enter the cycle with our observations on external developments.

Policy-makers in all countries / regions face two common challenges: climate change and increasing demands on limiting the ecological impact. In addition, some of the countries face a strong pressure to develop the coast and flood prone

3.1 Accelerated rising sea level: a very uncertain factor

Three sources of relative sea level change are present in the North Sea Region. Firstly, there is a well-known, natural rise of the sea level. Secondly, though surrounded by uncertainty, all policy-makers also incorporate (the possibility of an accelerated sea level rise due to climate change in their policies. An authority in this area for most countries/regions is the Intergovernmental Panel on Climate Change (IPCC) and the forecasts it makes. Thirdly, the land itself is also moving due to post-glacial rebound. In Denmark, this gives a limited uplift in the northern part of the country and a limited subsidence in the southern part. A limited subsidence occurs in the remainder of the regions. In the peat lands of the Netherlands, there is the additional problem of subsiding peat lands.

The majority of interviewed policy-makers presently deal with climate change by incorporating precautionary margins in design parameters. In general, the policy-makers have chosen to take the expected increase in the mean sea level (MSL) as the increase in the extreme levels. This means a rise in relation to the costs involved.

Most policy-makers note, however, that if storminess increases dramatically, a very different policy may be required.

In England the impact of external developments has been researched in a more integral way through the Foresight project (see the frame).

England: Exploring the future in the Foresight project

The UK Ministry for Science and Technology has started a project to explore possible situations with regard to flood risk in the year 2100 within its Foresight programme.

Under multiple scenarios, annual flood damages and defence costs are estimated. These scenarios include physical parameters but go further. They also look at economical, political and societal movements.

Community and local institutions are important, for instance, in the “Local Stewardship” scenario whereas “consumerism” is dominant and institutional structures are weaker in the “World Markets” scenario.

3.2 Increasing external regulation to preserve the ecology

Over the past decades, national ecological regulation has become stronger in all countries and regions as well as societal pressure to give more attention to the environment. On top of this, the EU has also provided regulation and, in particular, and perhaps most significantly, the Birds Directive, Habitat Directive and Environmental Impact Assessment Directives.

All interviewed policy-makers have indicated that this has considerably lengthened and complicated the planning and implementation of works. The ecological impact and necessity of works has to be analysed thoroughly. More attention has to be paid to minimising the impact and, in certain cases, compensatory measures should be taken by creating nature areas elsewhere when measures are implemented.

All policy-makers, however, feel that they can still carry out essential works, be it with delays. In this way, EU ecological regulation does not block measures.

3.3 Increasing demand for development in the flood prone area

Everywhere there is a certain amount of pressure to allow building on the coast. People are attracted to the coast for recreation and work.

A more general demand for space has been, however, noticed especially in Hamburg, England and the Netherlands. People have to live somewhere in these areas and other land is often already in use by humans or nature. This means risk increases in relation to most definitions of risk (see section 2.3) even if the probability of flooding remains the same.

Increasing ecological regulation in the Netherlands, Denmark and Flanders does, however, block building in flood prone areas, thus, effectively aiding flood risk management.

3.4 Challenges from external developments

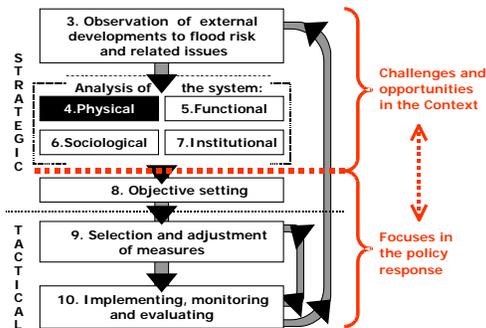
The three identified significant external developments are depicted in table 3.1. All countries and regions see climate change and the corresponding sea level rise as a major challenge. Ecological regulation is complicating and lengthening the policy-making process but is not regarded as a major challenge to existing policy. Development pressure is a major issue especially in the Netherlands and in England.

Table 3.1 Challenges from external developments

	England	Flanders	Nether-lands	Nieder-sachsen	Hamburg	Schlesw. Holstein	Denmark
Relative sea level rise	●	●	●	●	●	●	●
Ecological regulation	●	●	●	●	●	●	●
Pressure for development	●	●	●		●		

● Major challenge ● Challenge

4 Coastal system: physics



This section shortly discusses the physical system: the sea which may flood or wash away parts of the coastal defence and, therefore, may, possibly lead to the flooding of inland areas.

Table 4.1 provides an overview of the coastal systems of the countries and regions.

Table 4.1 Overview of physical aspects of the coastal system

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schl. Holstein	Denmark
Characterisation of sea extremes	Probabilistic	Probabilistic	Probabilistic	Deterministic	Deterministic	Both	Probabilistic
Coastal system	Varied (cliffs)	Dunes	Dunes, Marshes, Estuaries	Marshes, Estuaries, Dunes	Tidal river	Marshes	Marshes, dunes
Inland areas protected by flood defences	Partly	Fully	Fully	Fully	Fully	Fully	Partly
Indicative flood prone definition	None used	<+ ≈3 m / <+5m MSL	(<+5 m MSL) ⁶	<+5 m MSL	<+5 m MSL	<+5 m MSL	< +5 m MSL / < crest level
Area <+5 m MSL⁷	≈ 6 500 km ²	≈ 2500 km ²	≈ 19 000 km ²	≈ 6000 km ²	≈ 200 km ²	≈ 2 500 km ²	≈ 1500 km ²
Area ≈< 0 m MSL	Some	Little	Most	Some	Some	Little	Very little

4.1 Sea extremes

The most threatening conditions⁸ of the sea to the land of the North Sea Region are the result of a combination of tide and surge effect (due to wind). This results in high water levels and fierce waves. The profile of the shore's other conditions can have a significant influence on the height of the water level and waves.⁹

Methods of estimating extremes

“How high can the water rise?” is one of the most important questions a policy-maker will ask him or herself. A level cannot be set that the sea will for sure never exceed. All countries and regions mainly rely on past records to determine these values with some additional models for local forecasts.

Mostly a deterministic approach is used in Germany. From the record, the highest ever recorded level is by far the most important value. The other countries and regions use a probabilistic method; Schleswig-Holstein uses a combination of methods.

Dealing with uncertainties

Many uncertainties are present in relation to both the deterministic and probabilistic approach. The way these uncertainties are dealt with in predictions varies but often the stochastic character of frequency/reoccurrence figures is stressed (a 1:10,000 year storm may come by tomorrow) while not the uncertainty in the figure itself (we do not know for sure whether 1:10,000 is not 1:1000).

Extreme values not comparable

As the different countries and regions use different methods for calculating the extremes, these values cannot be compared. The extremes, however, are, in general, in the same order of magnitude¹⁰.

In addition to this, it can be said that the interviewees themselves pay much more attention to differences of topology in their regions than to differences in extreme water levels

4.2 The shoreline and its defences

The continental shoreline (from Denmark to Flanders) is strongly influenced by man. A dune shoreline with a relatively small foreland exists in the South (Flanders and Central Netherlands) and the North (Denmark). In between the Wadden Sea area is located with a marsh shoreline and often few natural defences although the marshes and islands in front of the main land do offer some protection. Smaller and larger estuaries and river mouths are also present, for instance, in Zeeland or the Weser estuary, protected mainly by dykes.

Most of the dune coast is protected against erosion by sand nourishments or fixed structures such as groins, wave-breakers and revetments¹¹. Dykes, however, are usually not necessary.

Along the marsh coast of the continental coastline, dykes have been built often to protect reclaimed land. Many of the river mouths and estuaries of the continental coast are closed off with barriers or storm flood barriers. Denmark has also some clay and soft rock cliffs. These

History of flooding

Over the centuries, flood disasters has claimed hundreds of thousands of lives in the North Sea Region. The most influential disasters of this age have taken place in the mid-twentieth century. The Netherlands, England and Flanders were hit in 1953. The German coast was hit in 1962. More recently there have been incidents (in 1976 Germany/Flanders, in 2000 Denmark, in 1990 and 1999 England and in 1990 Netherlands) but no major disasters have occurred.

In all countries, however, (except Denmark) river floods have occurred in the last ten years and this has made an impact on flood risk management in general.

are also vulnerable to erosion but as they raise several to tens of metres out of the sea, they are less subject to flooding.

In front of the main coastline of the Netherlands, Germany and Denmark, a line of islands separates the North Sea and the Wadden Sea. These Wadden Islands contain dunes although dykes are sometimes present on their southern coast.

England has a much more varied coastline. “Soft” coastal types such as soft rock cliffs and dunes are dominant¹² but at some locations there are low-lying areas and even polders with high dykes protecting them. In general, about two-thirds has some form of protection against erosion and/or flooding (Eurosion 2003).

England: Gradual definition of flood prone

In most countries a division between potentially floodable and high-grounds is made with regard to coastal flooding. In England almost always a more gradual approach is used of different levels of risk or at least different levels of probability of flooding.

For instance for spatial planning purposes different levels are distinguished, thus allowing for both probability of occurrence and probability of failure of defences.

This is closely connected to the ‘plan for all floods’ approach that will be discussed in the policy part.

4.3 Flood prone areas

The sea can often reach beyond the direct shoreline. How far it can get, differs from region to region and depends upon the definition used in relation to “flood prone”.

Often all land that lies beneath +5m below the national water datum is considered to be potentially floodable by the sea.

A more gradual method is used in England. Categories of flood proneness are used, for instance, in spatial planning based on probability of flooding (see the frame).

The largest flood prone areas are located in Flanders, the Netherlands and Germany. The areas prone to flooding in the UK are relatively small although still considerable in absolute terms. The area of low-lying land is limited in Denmark both in absolute as in relative terms. Refer to figure 4.1.

Table 4.1 provides some figures on the absolute and relative share of low-lying land.¹⁴ It should also be taken into account that the exact topography is an important factor. Especially areas below sea level are more vulnerable since they can be considered to be similar to “bathtubs”. The Holland region in central Netherlands is not quite comparable to any other coastal North Sea Region for this reason.

Figure 4.1 Areas < ≈ 5 m above MSL (indicative) in red (sinusoidal projection; areas are comparable in this projection).

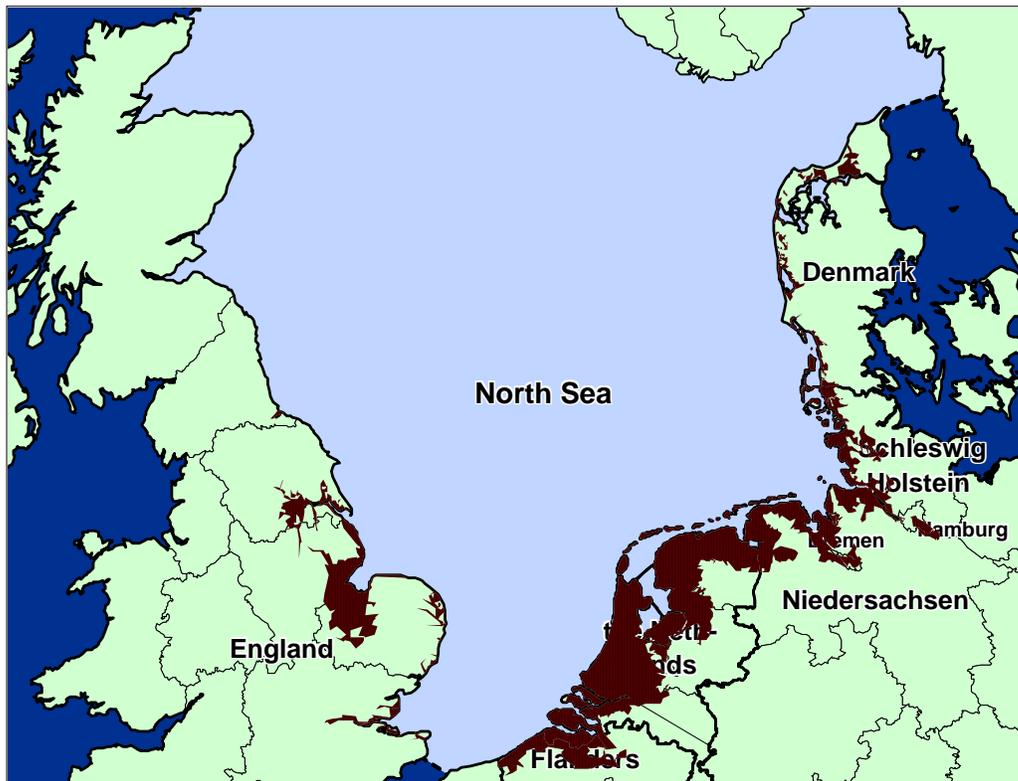


Table 4.1 Low-lying areas in the COMRISK countries/regions (Sources: map measurements from NIMA-DTED, CIA World Fact book)

Country/region	Surface <+5m MSL ¹⁵	Total land surface	Ratio
England	6 500 km ²	130 000 km ²	5%
Flanders	2 500 km ²	30 000 km ²	8%
Netherlands	19 000 km ²	34 000 km ²	55%
Niedersachsen	6 000 km ²	47 000 km ²	12%
Bremen	250 km ²	400 km ²	61%
Hamburg	200 km ²	750 km ²	29%
Schleswig-Holstein	2 500 km ²	16 000 km ²	16%
Denmark	1 500 km ²	42 000 km ²	4%
Total	38 000 km²	300 000 km²	13 %

4.4 Physical challenges

We end this section by summarising the physical threats and opportunities as presented in the previous sections. The German coastline offers the least natural protection. The Dutch physical context, however, is most challenging both in absolute and relative terms, though it has some protective dunes.

Figure 4.2 Physical opportunities and threats

	England	Flanders	Nether-lands	Nieder-sachsen	Hamburg	Schlesw. Holstein	Denmark
Large amount of flood prone area	●	●	●	●	●	●	
Deep flood prone areas	●	●	●	●	●	●	
Natural coastline offers little protection	●		●	●		●	●

● Major challenge ● Challenge

⁶ There is no formal definition in the Netherlands. Definitions used for estimates of the flood prone area in the Netherlands are +0 (rare), +1 and +5 metre. In practice, this makes little difference to the figures, due to the topology of the Netherlands (only a fraction is between 1 and 5 metres above the mean sea level).

⁷ Information based on the DTED0 database of NIMA (see www.nima.mil), which is based upon satellite measurements.

⁸ We leave out events such as a meteorite impact; these are not mentioned in any policy-document or by policy-makers.

⁹ Note that this subproject only deals briefly with this subject; the reader is referred to COMRISK subproject 5 (Hydraulic boundary conditions) for more information.

¹⁰ Van Gelder 1999 compared annual maxima of a number of gauge records along the North Sea. From these results it can be learned that levels under the same return levels are within the same order of magnitude. A number of more extreme differences may exist locally.

¹¹ See, for instance, the DWW's Dealing with flood risk study, NorCoast, for more details.

¹² Refer to Van Gelder 1999.

¹⁴ Ratios are based on the regions dealt with in this study. This figure is much lower on a national scale (about 3 %) especially for Germany.

¹⁵ Based on public DTED data of the NIMA agency of the US Dpt. of Defense (see www.nima.mil). Note that although these estimates are not without inaccuracies on the used vertical scale (metres), they provide a good indicative, general overview of the region.

5 The functions of the coast and flood prone inland areas

Attention was paid in the previous sections to the potential for flooding. The focus will be on what is at stake in these areas in this section: Which economic and other functions do they fulfil. Where are the conflicts?

Table 5.1 presents an overview on these issues.

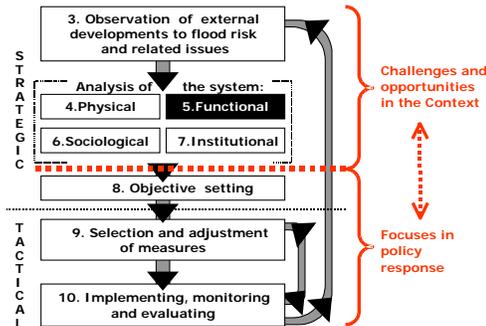


Table 5.1 Overview of socio-economic aspects related to flood prone areas

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schleswig-Holstein	Denmark
Functions		Agriculture, living, tourism, nature, ports	Living, agriculture, living, ports and industry, tourism, nature	Living, nature, ports and industry, agriculture, tourism	Living, ports and industry	Living, nature, ports, industry, Agriculture, tourism	Agriculture Nature, tourism, limited living
Density of use	Rural - very urban	Rural - urban	Rural - very urban	Rural - urban	Very urban	Rural and some urban	Rural
Population flood prone areas (approx; x1000)	1 000's	10's - 100's	10 000	≈1000 (incl. Bremen)	≈200	240	10's
Function conflicts	Development vs. nature	Development vs. nature	Development vs. nature			Development vs. nature	Development vs. nature

5.1 Socio-economic functions present

The types and size of socio-economic functions depend largely on the size of the flood prone area. For a country like Denmark and most of England, only the immediate coastal strip is threatened. For a country like the Netherlands, the flood prone area is so large that all types of land-use can be found in the flood prone area. The most important functions are given below.¹⁶

Agriculture

Both intensive and extensive agricultural areas are located in flood prone areas. In general the continental coast has more flood prone areas with intensive agriculture. Bordering the Wash area in the UK, however, high quality agricultural land is present.

Not only is agriculture often present in flood prone areas, many flood prone areas are the result of reclamation for agricultural purposes. This has been the case in Denmark, Germany, Flanders and the Netherlands and, in the more distant past, in England.

This reclamation has almost everywhere come to a halt. The main reason in Germany¹⁷ and Denmark is damage to landscape and ecology. In addition, the economic importance of agriculture has subsided everywhere. Limited reclamation takes place for the port of Rotterdam in the Netherlands. Large polders for agriculture, however, are no longer reclaimed.

Ecology

Most highly valued throughout the North Sea coastal zone are wetlands, the largest being the Wadden Sea. These are important to birds and other wildlife. Dune areas are almost all strongly influenced by human activities. The current landscape is still being regarded as a valuable nature area. Many parts of the coast have been given some form of protected status. Almost the entire Wadden Sea region is an international nature reserve.

Living

For the inhabitants of all countries and regions the coastal strip is regarded as an attractive place to live or, especially in Denmark, to have a (holiday) cottage. In the larger flood prone areas, moreover, many important urban centres such as London, Rotterdam, The Hague, Amsterdam, Bremen and Hamburg are present. In total about 14 million people live in areas that can potentially be affected by the sea of which 10 million live in the Netherlands.

Ports and related industries

A number of major European ports are located on the North Sea Coast, such as Hamburg, Rotterdam and London, and numerous middle-sized harbours. These ports and their associated industry are often regarded as crucial for the economy and employment¹⁸, especially in more rural areas, such as North Germany¹⁹. Ports are also considered vital in urban centres such as Rotterdam and London. One of the main requirements that ports need is a good connection to the sea and to the inland infrastructure.

Infrastructure

Where people live and work, infrastructure is present, especially in the larger flood prone areas. Roads and railways sometimes run in parallel to the coast in England and Flanders whereas, for instance, they are perpendicular to the coast in the Netherlands.

Tourism

All regions have important tourist areas that are mainly related to beach and dune recreation. Also tourist cities such as Amsterdam and London and other tourist sites are situated in potentially flood prone areas²⁰.

5.2 Urban versus rural areas

All the countries and regions have virtually the same functions available but the degree of urbanisation differs tremendously. There are densely populated cities such as London, Rotterdam, The Hague, Amsterdam, Bremen and Hamburg but also sparsely populated coastal strips as is the case in Denmark.

Both intensive and extensive agricultural areas are located in flood prone areas. Generally, the continental coast has more flood prone areas with intensive agriculture. Intensive agriculture is present in reclaimed areas in the North East of England on the UK coastline. It also has, however, areas that are used more extensively for purposes such as sheep grazing.

We should realise that there are differences within the countries/regions such as between London vs. North East England and between the urban agglomerations of Western Holland vs. the rural northern part of the Netherlands.

5.3 Conflicts between functions

As already mentioned in section 3, there is a demand for the space offered by coastal zones. Almost all space offered by the coastal zones of the North Sea Regions, however, already fulfil one or several functions. The tension between development and nature areas in relation to the ecology in general and recreation in particular plays an important role in almost all countries and regions.

Developments that may be implemented elsewhere are regarded as undesirable in the coastal zone directly adjacent to the sea in the UK, Schleswig-Holstein, the Netherlands, Flanders and Denmark. Denmark even has a 3 km restricted zone which is mainly to ensure landscape protection.

5.4 Challenges due to the use of the coast and flood prone inland areas

Table 5.2 depicts the challenges the policy-makers feel they have to face from social perceptions. Major cities in the Netherlands are situated entirely in flood prone areas. Hamburg and London are partly situated in potentially flood prone areas. Almost all policy-makers are faced with vulnerable nature areas on their coast, which limits and sets conditions in relation to coastal defences.

Table 5.2 Challenges from socio-economic functions

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Major cities threatened	●		●		●		
Designated nature areas	●	●	●	●		●	●

● Major challenge ● Challenge

¹⁶ Mainly based on the NorCoast and NorVision studies.

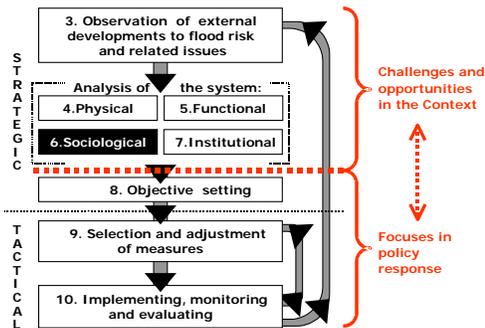
¹⁷ Government of Schleswig-Holstein, "Generalplan Küstenschutz".

¹⁸ See NorCoast, State-of-the-art Germany report.

¹⁹ According to Tegner; the service sector is by far the largest in all regions.

²⁰ NorVision and NorCoast studies.

6 Societal perceptions and attitudes towards flooding



We will address differences in the attitude of society towards flooding in this section.

We will first look at people's perception of the risk of flooding and subsequently focus on the relationship with policies: what does the public expect from government?

6.1 Perception of risk

In general, all interviewed policy-makers feel that the people in flood prone areas do not actually view the sea as being a flood-risk. They state a number of reasons for this.²¹

Firstly, some people do not know that they live in a flood prone area. This is especially true for people that have moved from inland areas to the coast and the younger generation.

People, furthermore, know that in the past floods have happened, for instance, they are aware of historic floods. They, however, feel that at present the defences are of such strength that flooding cannot ever happen again.

Finally, even if people are aware that flooding may occur, policy-makers have noticed that this does not necessarily lead to an urgent awareness of the problem.

Exceptions

There are also areas where a higher awareness exists. These areas are located in the eastern part of England, Hamburg and Denmark. All policy-makers explain this awareness by recent flood events as well as their own actions to raise awareness.

6.2 Demands and support for policy

Measure support and demand are at a high level in the Netherlands and in the German states. People demand a lot and support their government to quite a large extent but have a very low tolerance level for floods. It was mentioned, in particular, in relation to the Netherlands, that society as a whole puts pressure on central government to implement measures and to compensate for flood damage; for instance, after the near-flooding of the major rivers in 1993 and 1995.

This does not mean that coastal defence measures do not elicit specific protest. Protest actions are carried out, for instance, in Niedersachsen against ecological impact and

problems are being anticipated related to, for instance, demolishing houses for dyke strengthening projects in the Netherlands due to a “Not In My Backyard” attitude.

The awareness in relation to even the potential of flooding is quite low in Flanders. Floods that have occurred in the past have largely been forgotten. The main interest currently present is that defence works should not block or alter their view too much.

People living in flood prone areas in England demand high levels of protection. The responsible policy-makers, however, do not consider it necessary to protect all land.

6.3 Challenges inherent to societal attitudes and perceptions

The common challenge England, Flanders, the Netherlands and, to a lesser extent, Niedersachsen experience is to raise the sense of urgency among (some of) their citizens to make them either support governmental action or take action themselves.

It has also been said that citizens of Schleswig-Holstein do not seem to be aware of the risk but this has not lead to practical difficulties in implementing policy. Policy-makers in Hamburg and Denmark generally feel that the demand and support for action is about right.

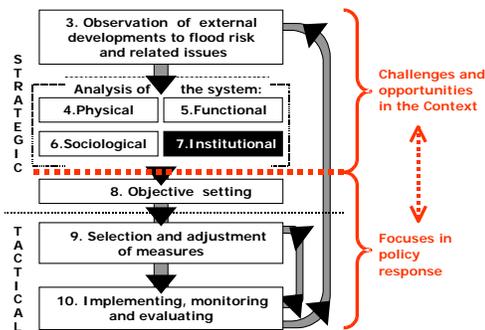
Figure 6.1 Challenges inherent to societal perceptions

	England	Flanders	Nether-lands	Nieder-sachsen	Hamburg	Schlesw. Holstein	Denmark
Low sense of urgency among citizens	●	●	●	●		*	

● Major challenge ● Challenge

*) *Limited awareness but not regarded as a problem.*

²¹ We only deal briefly with perceptions in this report on subproject 1. Perceptions of risk are the central subject of subproject 3 of COMRISK and will be discussed more extensively there.



7 Institutional context

Besides taking account of the physical system, socio-economic functions and societal perceptions, a policy-maker also operates in an institutional environment. We will first describe the responsibilities of the organisations involved in this section. Next, we will look at the method used for coordination within the government and between the government and the public. Table 7.1 presents an overview of the institutional context.

Table 7.1 Overview of the institutional context

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schl.-Hol.	Denmark
Involved levels of government	State - (Coastal Group) - Local	State ("gewest"; region)	Water board-County-National	State County (Bezirke) Water boards	National-City-State	Water boards-State	(Water board)-County - National
(Primary) policy department	Environment	Infrastructure (and environment)	Infrastructure and water management	Environment	Infrastructure	Home department	Infrastructure
Legal obligation to citizens	None	None	Legal design return periods within dyke rings Maintain coastline at 1990 position	Maintaining crest level at 'safe' level	Byelaw prescribed crest level	Dykes designed to withstand all storms	No.
Coordination between levels of flood protection authorities	Guidelines and grants are provided on a national level. Coordination is provided through coastal groups	(Dialogue with municipalities and province on design and implementation of works.)	Water board managed. Detailed guidelines are provided on a national level. National and provincial supervision	Funding conditions are set on a national level. Water boards carry out works and maintenance supervised by local ("kreise") and county ("bezirke") level;	The water boards only have a role in case of disasters	State approves works on secondary dykes of water boards.	Initiative taken by the county and approval provided on a national level. Consensus culture
Spatial planning	National guidelines; regional and local plans. Under revision.	Plans at several levels (state, county, local)	Binding plans on a local, county and local level.	Plans at state and local levels. Lower level follows higher level plan but lower level participates in higher level planning (counter-current principle)			County and municipal plans. Lower level has to follow higher level. Specific national coastal zoning
Disaster management	By police if life threatening; in other cases by local authority assisted by the Environment Agency in relation to floods.	Up-scaling principle (4 levels). Province important.	Municipality always responsible for coordination and assistance provided through up-scaling.	Up-scaling principle from "Kreise" (district) but very restrictive. The "Kreise" should have flood management plans (Hamburg: city-wide flood management plan)			Counties and municipalities have flood management plans and are assisted by the Danish Coastal Authority (DCA)

Funding of investments**	Up to 70% by the state and remainder by local government	State (“gewest”)	National government	70% by national government, 30% by member state	National, city state, EU	national, state, EU	State, county municipality water boards/landowners
Funding of maintenance*	Local government	State (“gewest”)	Water boards (tax specific)	Water boards (by specific tax)	City-state	State (secondary dykes by the water boards)	Water boards
Citizen/NGO involvement	Statutory consultation procedures. Part. of NGOs in coastal groups.	Mainly in procedures related to carrying out works	In early stage with (environmental) NGOs. Approval procedures for works.	At an early stage and in planning procedures (such as EIAs). SH has established advisory body (Beirat).			Landowner hearings, Spatial and nature decision procedures

*) *In bold the primary level. Levels of government are made comparable see table 7.2.*

7.1 Responsibilities of government

The starting point for the institutional structure is the (assumed or assigned) responsibilities of governments. Only in Germany and in the Netherlands a direct legal obligation to act exists. The law mainly assigns powers and not duties in the other countries and regions. In some cases, however, the informally assumed responsibility is more extensive than the formal responsibility.

Legal duties of government

In the UK, national government only has the duty to provide information (if available) to local planning authorities on their request but for the remainder the law only contains powers (right to act). The relevant legislation is the Coastal Protection Act and the Land Drainage Act.

Arrangements within legislation for coastal flood risk management are limited to a few general sentences in general law in Flanders. The main authority of the ministry of the Flemish community stems from the legislation responsible in making Belgium a federal nation.

There is a legal duty to act in the Netherlands. This duty is limited to the areas protected by dyke rings. The Netherlands is unique in the fact that legislation (since 1996) contains quantified standards. Three levels of protection from flooding are identified: one for the Wadden Islands (1:2000 years), one for the rural North and South West (1:4000) and one for the densely populated, low-lying Holland area (1:10 000 years). This is laid down in the Flood Defence Act. This Act also details the institutional organisation with regard to flood defences. A number of other specific water pieces of legislation also apply.²²

Coastal defence is defined in the constitution as a joint task between the states and the central government (Gemeinschaftsaufgabe) in Germany. Central government has chosen to

leave further legislation to the states. Legislation related to dykes in Niedersachsen makes it a governmental duty to maintain the state dykes at a “safe” level. The state has a similar duty in Hamburg through the Dyke Byelaw (Deichordnung) and Private Dyke Byelaw (Polderordnung). Legislation related to dykes in Schleswig-Holstein contains the duty to design the state dykes to withstand all storm floods.

Danish legislation is permissive as is the legislation in the UK. National government only has the duty to judge proposals on their impact on the environment and, for instance, on sediment processes. The power to undertake initiatives is given to the counties through legislation.

Non-legal “duties”

Duties from a legal angle have been discussed above. Not all responsibilities, however, have been defined in legislation. Responsibilities are also related to societal expectations as has already been mentioned (see section 6.2). These informal duties seem to be especially strong in Flanders and the Netherlands. The differences among the legal and non-legal duties and responsibilities seem to be a lot less in the UK and Germany.

Though there are no legal obligations in Flanders, it is generally felt that the government should provide protection to all residential houses. National government is *de facto* the primary responsible party in coastal flood risk management. Dutch policy-makers at all levels have noticed that society expects government to provide protection to all citizens against any flood. All policy-makers (Dutch and Flemish) regard this situation largely as a fact.

The Danish government considered that the ‘optimal’ amount of protection was at some places below the societal acceptable level in the 1980’s: the Danes expect a certain minimum amount of protection of land that is in use.

In practice, however, governmental responsibilities are distributed over many governmental units. We will first look at which departments are involved at a high-level of policy-making (section 7.2). Next, we will discuss how flood risk management is organised.

7.2 Policy-making departments

There are differences among countries in relation to which department has the primary policy role (or the “director” role) for flood policy. In the UK, this is the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (under DEFRA) for operational affairs.

In Flanders, the Department of Infrastructure and Environment is responsible. The responsible section is most closely connected to the infrastructure part. In the Netherlands, the Ministry for Transport, Public Works and Water Management is responsible and, in Denmark, this is the Ministry of Transport.

In Germany, we find differences: at the national level, it is the ministry for Consumer affairs, Food and Agriculture. At the state level in Lower Saxony and Bremen it is located at the Environment Department. In Schleswig-Holstein it is part of the ministry of Interior (which is an extensive ministry) in Hamburg it is in the Public Works and Transport Department.

Coastal defence policy and coastal management are dealt with by the same departments

All countries/regions have in common that they (or their agencies) are the managers of the coast and (to some extent) responsible for coastal defence besides being policy-makers.

Spatial planning and disaster management are dealt with by different departments

The primary policy-making organisation has responsibilities with regard to coastal defences in all cases. This ranges from a responsibility that is limited to general policy and guidance to being responsible for the actual management of defences.

Other relevant policy fields such as spatial planning and disaster management are, generally, dealt with by different departments. In almost all cases, the spatial planning process is the primary responsibility of a different organisational unit within government. Spatial planning is only dealt with by the same department in Schleswig-Holstein even though this happens at a considerable organisational distance from the coastal protection unit.

Storm flood warning services are mostly the responsibility of the primary policy-maker in most countries although national government is the primary party that issues storm flood warnings in Germany. Only for the UK, will this also include information dissemination to the public. Storm flood warning services are provided on a state level in Niedersachsen.

7.3 Organisation of flood risk management

Flood risk policy is formulated at different levels of government (except for Belgium, where only the state level (“gewest”/gemeenschap; district/community) is involved). A comparison between levels of government between countries is made in table 7.2. The involvement at different levels of government will be discussed in this section. For clarity, each country will be discussed separately.

Table 7.2 Used terminology for levels of government

This document	National	State	Region	Local
UK (England)	National	Kingdom	Region/County	District (local authority)
Flanders	National/ Federal	Community/ “gewest”	Province	Municipality
Netherlands	National		Province/Water board	Municipality
Niedersachsen	Federal	State (Land)	Bezirke (under rev.)	Water boards/Kreise/ Gemeinde
Bremen/Hamburg	Federal	City-State		
Schleswig-Holstein	Federal	State (Land)	(Regional offices of the state/groups of water boards)	Water boards/ Kreise/Gemeinde
Denmark	National		Region (Amt)	Municipality/Water board

The UK (England)

Two layers of management are present in the UK: a formal layer of statutory responsibilities and an added layer for coordination purposes.

At the formal level, stretches of coast are operated either by the Environment Agency (EA) or by local authorities. These local authorities are mostly district councils but they can, for instance, also be the managers of nature parks.

In general, the EA manages the more flood prone stretches and the local authorities manage the more erosion prone stretches but this is not always the case by definition. The formal division of responsibilities is quite scattered. On top of this statutory layer, however, non-statutory coastal groups have been formed in order to practice integrated coastal management. These groups draw up shoreline management plans for this purpose.

As well as there being direct management of stretches of coast, spatial planning processes also take flood risk into consideration. The planning authorities are mostly the districts. Strategic plans are developed on a broader scale on a country level.

The Office of the Deputy Prime Minister produces planning guidance on a national level. This Office is specifically involved in providing guidelines on how planning authorities should deal with flood risk. These guidelines are considered important although they are not formally binding. Currently, the entire planning system is under revision, which may result in the regions being given a much more powerful role. How this might affect guidance with regard to flood risk is not yet clear.

The EA can be consulted on available information on the flood-risk in relation to specific developments. The advice given by the EA in these cases is followed in the majority of cases.

The police and the local authorities are primary responsible in relation to disaster management. The police manage crises if and only when they are life-threatening. If they are not life-threatening, local authorities will take over.

Flanders

Flood risk management is mainly the responsibility of one organisation in Flanders: the Department for the Environment and Infrastructure. Within this department, coordination takes place, especially between the nature and coastal works divisions.

Flanders is, however, currently planning to radically change the scope of its flood risk management (see the frame in section 8), which could also lead to a much wider involvement of organisations such as, for instance, organisations involved in spatial planning and disaster management.

The Netherlands

Of all the COMRISK countries, the role of national government is strongest in the Netherlands. National government does not only set standards for coastal defence (through legislation) but also provides quite detailed technical guidance. National government also provides specific consultancy through its specialist services.

The interviewees observed that this concentration regarding coastal defence at a national level is almost unavoidable since Dutch society considers all floods as a matter of national importance.

The construction, maintenance and management of most coastal works, however, is left to the water boards, with the exception of the sea defence works located in the Wadden Islands, sand nourishments and the main storm flood barriers and barriers in general.

The county (province) supervises the water boards whilst national government acts as the supervisor at a higher level in relation to the coastal flood defence. Governmental organisation forums exist on a county (provincial) and national level which are responsible for the coordination between the various governmental departments.

Spatial planning is dealt with at a municipality level. Local plans are legally binding for citizens. At a provincial and national level, however, spatial plans are also made. In general, the lower levels have to stay within the limits of the higher-level plan.

Recently links have been established between planning processes and fluvial/rain flood risk management through the “water test” (“watertoets”) procedure. This test, however, does not

take coastal flooding into account. Discussions are also ongoing in relation to the extent to which this test is binding.

The mayor of the municipality is the primary authority when it comes to disaster management. The main operational party are the fire departments. The link between coastal flood risk management and disaster management is - at least with regard to the central Holland area - quite weak. Currently, these links are being strengthened in the Zeeland area through the ESCAPE project.

Germany

The national level only plays a limited role in coastal defence in Germany as a co-financer. Principles, however, have been defined in relation to this funding which is quite crucial to most projects.

Spatial planning regulations are limited to forbidding building work in front of and very close to the defences. Since dykes are placed very close to the shoreline, these regulations only affect very limited areas. The Kreise (district) is firstly responsible for disaster management in Germany but it can be up-scaled if multiple “districts” are affected at higher levels.

Germany – Niedersachsen (and Bremen)

Several levels of government are involved within Niedersachsen. The state has set out the general policy and regulation through its legislation regarding dykes. This also holds for the technical guidance regarding dyke design. It operates some major works and the storm surge barriers. It maintains the coastal region in most areas and the main land dykes in a few areas. It manages all defences in relation to the islands.

The Bezirke (regions) calculate the design crest levels and is responsible for the highest supervision level in relation to dykes. They also regulate activities related to the dykes themselves. The Bezirke also have to approve major reinforcements (beyond the original design parameters). The Kreise are the lowest supervisory authorities that allow activities to take place. The water boards carry out all works within the design limits of the dykes and take care of the maintenance and operation of the coastal defence.

There is no Bezirke and Kreise levels in Bremen since it is a city-state. Their tasks are being performed by the Senate, which has a quite similar role to the Niedersachsen environment ministry for what concerns the other tasks involved.

Germany - Hamburg

The main government level involved is that of the Hamburg Senate. The public works and transport authority (Behörde für Bau und Verkehr) builds, maintains and operates defence works that protects residential and rural areas. This office has delegated power to the

department of port and river engineering in relation to special issues. This department plays a role in subsidising and regulating private dykes built by firms in the port area.

Disaster management (Katastrophenschutz) is the responsibility of the Home Affairs authority (Behörde für Inneres) which is actively involved in preparing flood management and evacuation plans.

The role of the water boards is limited when compared to Niedersachsen. They are only involved in reinforcement and repair work during/after high water.

Germany – Schleswig-Holstein

The primary and main dykes are designed, built and maintained by the state Ministry of the Interior in Schleswig-Holstein. This is specifically the case in relation to the coastal division. Much of the work is performed in the regional offices.

Secondary dykes are the responsibility of the water boards. Their work are approved and supervised by the state coastal division.

Schleswig-Holstein: Advisory council

Recently an advisory council (Beirat) was set up to discuss and initiate actions at an early planning stage and at a more strategic level in Schleswig-Holstein. Both governmental and non-governmental parties are represented. Specific issues such as secondary lines of protection and erosion are discussed in subcommittees.

Denmark: Coastal Authority as pivot

The Danish Coastal Authority is involved in all aspects of coastal management. In an early study they were considered to play the pivotal role in coastal management (Borup 1999).

With respect to flood risk management they are involved in spatial planning, building codes, the disaster funds and of course the coastal defences.

Denmark

The most important role is assigned to the regions (Amter) in Denmark. Flood safety is their primary responsibility and they are responsible for initiating new projects. Water board involvement has a long history in the Wadden Sea. Nowadays they still serve as an important link to the public.

Government at a national level also has a considerable role. The Danish Coastal Authority approves, co-finances and designs new flood defence work and monitors existing works. The DCA also advises disaster management authorities on their flood management plan. The DCA is also involved in the Flood disaster fund (refer to section 9.2).

7.4 Participation in the policy process

Citizens and non-governmental organisations have in general two ways in which they can participate in the process: at an early planning stage and during the approval procedure for specific defence works. The latter is, mainly, largely determined by general regulation on public works. Early involvement has increased in most countries and regions.²³

The Netherlands: Setting the agenda in dialogue

There has been a trend towards more involvement at an early stage of policy-making in the Netherlands.

One example of this is the "Policy agenda for the coast" project. Issues for policy-making were identified in a series of meetings with governmental and non-governmental organisations. These will be worked out further and will be incorporated in a new policy document.

Citizen involvement has, in general, increased over the years in the UK. Consultation rounds are the main instruments that are used. Consultation is held for strategy as well as concrete projects. Currently, consultation related to a new flood strategy is ongoing.

Any organisation or citizen may give a viewpoint during these consultation rounds. A number of organisations, statutory consultees, must be heard.

Public participation in Flanders is currently mainly related to the actual implementation of construction works. Issues such as noise during construction work or the blocking of views because of defence walls are discussed. There are some possibilities to discuss the general policy but the public very rarely uses these

possibilities. Policy-makers in Flanders are, however, planning to change this and to initiate a broad societal discussion on safety standards.

There are extensive public participation procedures related to building and spatial planning processes in the Netherlands. Discussion meetings were held with NGOs and the public on various themes within the framework of a new national "agenda" for the coast. Individual citizens are less involved at a strategic level.

Most projects require public consultation within the approval procedure in Germany. An advisory council (Beirat) has been put in place in Schleswig-Holstein in which both governmental organisations and non-governmental organisation participate in relation to participation on a more strategic level.

Elected citizens manage the water boards in the Netherlands, Germany and Denmark. These water boards consider themselves an additional, democratic link with the public.

7.5 Funding

Multiple organisations are involved in the funding process in all countries except Flanders. Part of the funding is collected through a special tax scheme targeted at those that receive the protection in the Netherlands, Germany and Denmark. The remainder of the funding is obtained from taxpayers in one way or another. Table 7.3 gives a general overview of this situation.

The funding situation is quite complex and currently under review in the UK. It is currently organised as follows in general terms:

- The Regional Flood Defence Committees constitute the central funding body. The Environment Agency and local authorities are represented in these committees. They decide on the proposed spending on a project basis. Local authorities are funded through the Office of the Deputy Prime Minister (as part of general local government funding).
- In most cases, additional and specific central government funding is required. This is done through DEFRA. DEFRA assesses and then scores (according to guidelines) proposals in two phases: first, an indicative go-or-no-go is given in a preliminary phase and, later, a final decision is given. The highest scoring proposals receive a grant. In addition, DEFRA sometimes gives out credits to local governments.

Currently, assessments are taking place to decide whether each individual project should be assessed separately or whether a specific budget should be assigned to each defence committee which can be spent as deemed fit.

Funding in Flanders is organised through an annual budget process of the department.

Funding in the Netherlands has just been revised. Nourishments (to compensate for structural coastal erosion) are performed and paid for by central government. New defences and significant strengthening work are carried out by the water boards. These are funded by 80% and, in the future, by 100% through central government. Some discussion is ongoing to involve commercial parties in the funding of sand nourishments that, for instance, widen the beach. Water boards are partly (20%) funded for maintenance purposes by national government and, in the future, they need to be entirely self-dependent in this respect.

The arrangement between the state and central government in Germany is such that (a maximum of) 70% is paid by central government and 30% by the states. Central government sets the total, maximum amount of available funding. This sum is then divided over the states each year in dialogue with the states. In general, federal funding is not the limiting factor (with the exception of Hamburg).

Limits in relation to available funding do not, in general, lead to compromises on the design protection level but to delays in the achievement of these levels in Germany. Projects are prioritised which means that the most important projects can be carried out with a minimum of delay.

The main land dykes are mostly maintained by the water boards in Niedersachsen. Only works that are related to changed design parameters are, generally, funded by the state and federal government. In Hamburg and Schleswig-Holstein the water boards play a less important role and almost all funding is done by state (and federal government).

Local governments and water boards always fund maintenance work in Denmark. The ministry of Transport provides subsidies ranging from 35 to 50% (although in exceptional cases up to 80% of investments will be funded) in relation to investments made with regard to the North Sea coast. The DCA helps local authorities when drafting proposals to be submitted to the ministry but is not formally involved in the subsidy procedure.

Due to general budget cuts in the Danish administration, the budget for sand nourishments has recently been reduced. It might be a challenge to maintain long-term safety on a permanently reduced budget.

Table 7.3. Funding arrangements for defences

Country	Investment		Maintenance	
Denmark	National government	Amter, municipalities	National government	Amter, Landowners
	35%-50%	50%-65%	0%	100%
Germany*	State	Federal		
	Min 30%	Up to 70%		
The Netherlands*	National government.	Water boards	Water boards	National government.
	100%	0%	80% (present) 100% (future)	20% (present) 0% (future)
Flanders	State (region)		State (region)	
	100%		100%	
The UK**	Local	State	Local	State
	100% / 55%	0% / 45%	100%	0%

*) Sand nourishments are treated as investments.

**) A limited amount of funding is each year divided among the highest scoring project proposals. Projects that do not score high enough, do not receive money. Hence the possibility of 100% / 0% arrangements.

Available means to act

The budget has been increased in the UK and will likely continue to increase over the coming years. It is, however, considered to be impossible to fund all projects that meet the initial criteria. In Flanders, this is slightly less the case. The more limiting factor in these regions is the fact that staff capacity does not seem to meet project requirements.

In the Netherlands, all those interviewed felt that in the end funding would be made available to maintain the current legal safety standards. The national importance of these implementing these safety standards and the societal perception in relation to the

catastrophic potential should safety measures not be implemented play an important role in this. A discussion being held on another level is, however, important. Current legal standards are based on an economic analysis (for the Holland dyke ring) performed 30 or 40 years ago and are now felt to be outdated. The huge amount of investment that would be required to implement new standards is, however, considered unfeasible.

Funds are not always available in Germany to immediately strengthen dykes to meet standards. This leads to the prioritisation of projects to be implemented. Projects that receive a low priority are considerably delayed. This, however, is not regarded as a major issue.

Denmark is the exception when it comes to availability of means: they are considered sufficient. This might change in the future when general national budget cuts are implemented.

7.6 Challenges from the institutional context

Limited staff capacity and budget is a common challenge for policy-makers in all countries. The challenges regarding integration of policy fields and levels of government are more ambiguous. Links are not strong in relation to certain policy fields but often the primary policy-makers do not consider this as a major issue. All interviewed parties consider that the vertical integration in the UK has improved but a “national policy vacuum” seems to exist on a local level.

Table 7.4 Challenges from the institutional context

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Limited staff capacity		●					
Limited budget	●	●	●	●	●	●	●
Limited relation to disaster management policy		●	*				
Limited relation to spatial plan. policy		●	●				
Limited vertical integration.	**		●				

● Major challenge ● Challenge

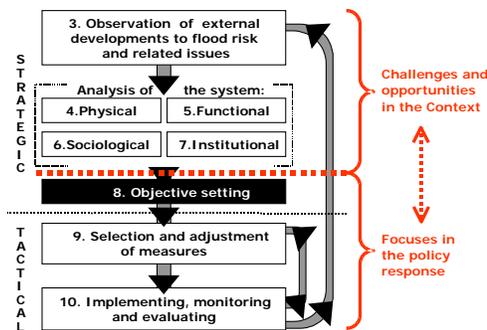
*) *The relation is limited but is not regarded as a problem.*

***) *There seems to be a policy vacuum on a local level.*

²² For instance the Waterstaatswet regarding the construction, maintenance and management of flood defences. Recently in this law articles have been added regarding the duty of flood defence managers to make emergency / disaster plans.

²³ For detailed information please refer to subproject 3 of COMRISK.

Part C Policy and strategies



8 Risk assessment and objective setting

Risk judgement and goals are closely related. Goals of risk management and present risk are expressed in the same terms.

We will first look how governments express risk and what their general assessment is. Then we will look how these lead to goals for risk management. Table 8.1 provides an overview.

Table 8.1 Overview of risk assessment and objective setting

	England	Flanders	Netherlands	Niedersachs.	Hamburg	Schl.Hol.	Denmark
Dominant expression of the risk	material(ised) damage on a yearly basis	Break through probability	Break through probability	Height of dykes compared to historic extremes (safe or unsafe)	Height of dykes compared to "worst case" simulation (based on historic extremes)	Height of dykes compared to historic extremes, break through probability.	Break through probability
Longest time horizon considered	Up to 100 years	Lifetime of works	Up to 200 years	Lifetime of works	Lifetime of works	Lifetime of works	100 years
Focus on type of events and damage	Broad scope (some focus on material damage)	Disastrous flooding and storm damage in dunes	Catastrophic flooding; in recent years more attention towards storm damage in dunes.	Large, life-threatening flooding	Large, life-threatening flooding	Large, life-threatening flooding	Small to medium - sized flooding
Emphasised other interests in trade-offs	Economics Ecology	Safety	Safety	Safety	Safety	Safety	(Landscape preservation)
Distribution of protection	Economic optimisation	Equal protection level	Combination of equal safety and optimisation	Equal protection level	Equal protection level	Equal protection level	Combination of equal safety and optimisation
Objectives and standards for works	No loss-of-life 80 000 properties less exposed than in 2003 by 2008. Indicative standards ranging from 1:5-1:200 (London statutory 1:1000 years)	No-loss-of-life Reasonable protection of houses in dune area 1:1000 years break through probability of dunes	Break through probability exceedance probability of water levels/storm conditions that defences should be able to withstand (1:2000, 1:4000/1:10 000 years (based on legislation) of primary defences	Design level of defences = highest recorded in relation to all components + margin	Design level of defences = highest recorded in relation to all components + margin	Design level of defences is the maximum for a 200-year return period and highest ever recorded.	Minimum standard of 50 years, higher where economically justifiable (Ribe and Tonder 200 year). 1000 years protection for Thyboron.

8.1 Characterising the risk

Expressing the risk

The way the risk is expressed in the policy process is discussed in this section.²⁴ We will mainly look at the most widely used statements and definitions in policy documents and policy discussions. The main difference is whether the consequence component of risk is explicitly referred to as well as the probability.

Risk is mostly expressed as (the integral of) probability x consequence in the UK. This leads to annual average damages. Another frequently used expression is the number of properties at risk.

The main expression that is used in Flanders, the Netherlands and Denmark is the return period of water levels beyond the design level of defences. Flanders and the Netherlands are both about to implement a major policy shift towards using expressions that also take into account the consequences of flooding. This is often referred to as switching to “risk-based” approaches.

Flanders: (R)evolution in coastal flood risk management

Coastal flood risk management currently has a very narrow scope. It is largely limited to coastal defence.

Flemish policy-makers, however, are planning a major paradigm shift in relation to their policy. This will introduce a “risk-based” approach which will assess the consequences of flooding, as well as the probability.

This will open the way for societal discussion on the protection level including possible differentiation of protection levels. Also a connection will be made to spatial planning and disaster management.

The Netherlands: Calculating the consequences

The consequences of flooding are not currently being quantified. Only the probability of dike failure is quantified.

An assessment of the consequences of flooding is made in the FLORIS (VNK) project. This will include material damage but also victims.

The results of the FLORIS project may create a basis for a renewed discussion on the standards of coastal defences in the Netherlands.

Coastal flood risk is mostly treated in a deterministic fashion (not related to probabilities) in Germany. The present dominant methodology does not allow for the distinction between different levels of risk or safety in Niedersachsen and Bremen. Studies have been performed in the background to determine the consequences and probability of failure.

The main characterisation of the risk in Hamburg is the difference between the highest ever-recorded level and the design level of the defences. A combination of probabilistic and deterministic methods is used: both the estimated return periods and the highest recorded value are important.

Risk assessment/Risk focus

The main concerns at present in the UK are related to material risk mainly related to buildings.

There is an explicit ambition in the UK to take all

possible consequences, including loss-of-life, into account. Of all COMRISK countries/regions involved, only in the UK is the risk of damaging nature due to flooding considered explicitly.

Two main event types are considered in Flanders:

1. Erosion of dunes during storm conditions which lead to the damage or collapse of buildings present in the dunes; and
2. Defence break through which leads to inland areas being flooded.

The second situation, in particular, is considered to be potentially life-threatening.

A similar situation exists in the Netherlands. Spatial development in the coastal zone is subject to policy discussions. The main concern, however, still is inland flooding. In general, this is considered to be potentially very catastrophic and (almost) beyond the coping capacity of the Netherlands.

Inland flooding is the main concern in Germany due to the type of coastline. Secondary dykes are present, however, that are generally thought to be able to limit damage due to past risk management. Germany, just like the Netherlands, has a long history of disastrous floods and floods are still considered to be potentially catastrophic.

The risk is considered to be relatively small in Denmark mainly because very few urban areas are potentially prone to coastal flooding.

Time horizon

The time horizon widely used for policy-making is related to the technical lifetime of defence works when, for instance, determining the allowance to be made for climate change. Two exceptions have, however, been identified:

- (Very) long-term considerations do play a considerable role in the UK; for instance, in the consideration that dykes will require maintenance indefinitely. Another good example is the Foresight project in which an analysis is made of possible situations in the year 2100.
- The very long-term perspective was discussed recently in the Netherlands by the “Committee for water management in the 21st century”. The main concern here is the long-term effects of sea level rising, subsiding peat land and the increase of buildings close to the sea and rivers. Legislation prescribes a 200 year time horizon, which has been used in the latest coastal policy plan to make spatial reservations for dyke and dune strengthening.

8.2 Trade-offs between spending and risk reduction

The main trade-off for all governments is the spending on risk reduction they can provide. Important is how the available means are distributed between the various flood prone areas. The general principles will be discussed in this section while the standards are discussed in section 8.4.

The emphasis in relation to these types of trade-offs in the UK is in maximising the benefit to society as a whole, that is, to get “value for money”. Given limited available means, they should be spent on the projects with the highest benefits (see the frame).

There is no explicit trade-off at present in Flanders. Flanders, however, plans to shift to a risk-based approach (see the frame in section 8.1). The future safety level to be set will be the result of a societal discussion. A lower level of protection is considered to be acceptable in Flanders for buildings that can be found in the dune zone.

An economic optimal solution was sought after the 1953 flood in the Netherlands where the difference between the costs related to protection and average benefits from avoided damage was

largest for the most important flood prone area.

Schleswig-Holstein and Niedersachsen: Optimizing the order of implementation

In Schleswig-Holstein a differentiation of protection level is considered inappropriate from the perspective of both politics and society. As a result standards of all dikes have remained the same.

Nevertheless the Coastal Protection division has found a way to take differences in the consequences of flooding into account.

The dikes of the areas with the largest potential for damage are raised first. As the project runs for decades, this is a significant policy. A similar approach is used in Niedersachsen.

England: Value for money by project appraisal

For obtaining grants from the national government, the Environment Agency or other operating authority has to submit proposals.

If they meet basic requirements, they are scored on their cost-benefit ratio, the reduction of high-risk situations, the contribution to deprived areas and environmental protection.

These scores are added. Each year a threshold is set, projects have to exceed it in order to receive grant money. In this way money is each year spent on the most profitable projects.

Due to increase of funding this threshold will become lower in the coming years. On the longer term, the funding might be reorganized.

The level of protection for other areas has been differentiated but this has not been based on an optimisation. Most likely *de facto* balance has been chosen between economic optimisation and equity where rural areas have a lower level of protection but not lower than economically justifiable. A new societal discussion about safety level is foreseen once a new monitoring system is ready that will quantify both probability and the consequences of flooding.

Dutch legislation makes a sharp distinction between areas within and outside the protection zone (the so-called dyke ring), which are laid down in the registers of the water boards. Buildings outside the protection zone do not have a guaranteed protection level but the policy-maker does pay attention to this problem by,

for instance, encouraging local authorities not to allow further developments in this area.

The basic principle in all German regions is that every citizen (behind the state dykes) has the right to equal protection: all primary dykes are designed to withstand all extreme conditions. Life-threatening potential plays an important role in this: it is considered inappropriate to protect some lives to a larger degree than others and, therefore, all citizens in a state that live behind state dykes are protected by applying the same safety standard.

The deterministic methods in coastal flood risk management used in Germany mean that explicit trade-offs are difficult. The methods used in Niedersachsen and Bremen simply identify a level that is considered "safe". The practical implication of this legal obligation would mean that an almost infinite level of protection (dykes to be designed to withstand all floods) is required in Schleswig-Holstein.

In Hamburg, the difference between the design level and estimated highest possible level is regarded in some ways as the protection level. Hamburg has decided to account for "metropolitan additions" ('Metropolzuschlag') in relation to all primary dykes by considering the presence of densely populated flood prone areas.

An approach is used in Denmark in which a combination of measures should ensure that damage, if not prevented by coastal defences and evacuation, will be compensated. This will be discussed more extensively in the next section.

8.3 Trade-offs with other interests

Other interests are, of course, also involved in flood risk management and not just protection and spending. These have already been mentioned in the context sections. All countries do try to reconcile interests such as the environment. The trade-off (principles) countries may make, however, may differ.

The UK emphasises the search for a balance between the interests. No particular interest is prioritised in advance. The economy and ecology, however, are emphasised especially when compared to other countries. Projects must in principle be economically and ecologically sound.

The general approach In Flanders and, especially, in the Netherlands and Germany is that the desired safety level *must* be reached and other interests need to be given as much attention as possible. Spatial interests are increasingly being addressed (see the frame).

Landscape preservation is considered extremely

Flanders and the Netherlands: Spatial quality as criterion

Both in Flanders and the Netherlands, providing spatial quality (such as view, beach width, etc.) has become an important additional interest. The way this is put into practice is, however, different.

Tailor-made solutions are sought for each individual case in Flanders.

Spatial quality needs of all weak links in sea defences, together with flood risk, are considered and are used to prioritise in the Netherlands at a national level.

important in the Danish coastal zone. Conflicts, however, with coastal defences do occur even if it is rare.

8.4 Set objectives

The previous sections have discussed the expression of the risk as used by the countries and regions and the trade-offs made. This section will discuss the specific objectives that have been set for each country. The objective types differ from country to country and, therefore, are not always directly comparable.

The UK

In the UK, objectives are set at several levels. The Department for Environment, Food and Rural Affairs (DEFRA) has set the following high-level aim:

To reduce the risks to people and the developed and natural environment from flooding and coastal erosion by encouraging the provision of technically, environmentally and economically sound and sustainable flood defence measures.

Service Delivery Agreements are made with the Environment Agency. The main targets related to risk are:

- To have no loss of life through flooding.
- To have 80 000 less exposed properties.

In addition, a number of targets relating to specific instruments have been set.

Flanders

In Flanders, the explicit objectives are to:

- Avoid loss-of-life (zero tolerance to deaths).
- To protect inland areas with a 1:1000 years return period.
- To provide a reasonable level of protection to buildings in the dune strip.

As said before, Flanders plans a significant paradigm shift, which will lead to a different set of objectives. This might include differentiation of the safety level.

The Netherlands

The high-level aims in the Netherlands have been formulated (in the first coastal policy document) to be the following in 1990:

- Maintaining the protection against flooding in a sustainable way.
- Sustainable preservation of the functions and values in the dune zone.
- “Dynamic” holding of the coastline.

The formally protected zones (dyke rings) in the Netherlands are divided into three groups (with regard to coastal flooding) of protection levels (exceedance probability of water levels/storm conditions). The islands in the Wadden Sea are protected by a 1:2000 years standard. The more rural North and South are protected by a 1:4000 standard and most of the Dutch coast (behind which the main urban areas of the Netherlands are situated) is protected by a standard of 1:10 000.

Currently, the ambition exists to at least maintain the current probability of flooding and to keep any building development to a minimum in relation to the areas outside the formally protected zone. This policy is currently under review. Furthermore, an explicit criterion since the last policy document is the spatial quality of areas.

Germany

The set objectives in Germany relate mainly to the design of the dykes. Crest levels and other design parameters are laid down in legislation (laws and byelaws) in Lower Saxony, Bremen and Hamburg.²⁵

Protected against life-threatening flooding from storm surges and from the damaging effects of the sea, the people live, work and recreate now and in the future in the coastal areas.

10 development objectives have also been set (sometimes referred to as the Ten Commandments for coastal defence). The most important for coastal flood risk management are:

- The protection of people and their homes by defences has the highest priority;
- The protection of ground and property by defences is considered very important;
- Realignment or abandoning of defences is only possible in exceptional cases;
- The long-term sustainability of the Wadden Sea is aimed at;
- Morphological and climate changes are carefully assessed out of precaution for the future. A rapid response is facilitated by early planning using scenarios;
- Nature and landscape are in the implementation of coastal defence spared as much as possible. Development and changes with respect to other interests are facilitated;
- All coastal protection measures are implemented in a sustainable way.

Denmark

The main objective has been formulated as follows in Denmark²⁶:

“Necessary coastal protection should be allowed but less is better”

The following guidelines are linked to the above:

- Coastal/flood protection can be allowed only where human life and/or significant values are at stake;
- Nature preservation is has a high priority especially free coastal dynamics;
- If old coastal/flood protection works are re-done, they must be minimised and redundant protection removed;
- Coastal/flood protection works must be technically optimised and must fit into the existing land/nature in a discrete way.

8.5 Areas focused on in relation to risk assessment and objective setting

Our assessment does not consider the actual objectives formulated. Choices between equity and economic optimisation are subjective and based on principles. This means that if, for instance, economic effects are estimated and considered but given a low priority, this can still be a focus point.

We have investigated three aspects related to the methods and considerations used:

- The taking into account of the needs of future generations;
- The taking into account of economic costs and benefits;
- Thee taking into account of the ecological carrying capacity.

The UK and the Netherlands focus on using a multigenerational time horizon. They have explored the long-term demands for coastal protection. The other countries have mostly limited themselves to studying how the current level of protection could be maintained over a long time horizon.

The UK has a strong focus on calculating economic costs and benefits; the benefit-cost ratio is calculated for every project. Current standards in the Netherlands and Denmark have been set decades ago with much consideration given to costs and benefits and are currently being updated.

Hamburg and Niedersachsen (in the Weser-Ems region) have done some quantification of damage potentials. Since, however, legislation prescribes that every German citizen should have the same protection level, the dyke design regulation does not distinguish between protection levels and so this aspect cannot be directly incorporated into the decision-making

process. Schleswig-Holstein has incorporated this type of information by setting priorities related to implementation.

The way the ecological carrying capacity is taken into account is quite similar since the EU regulates issues such as environmental impact assessments and the protection of habitats.

The UK also takes the protection of the coastal defences themselves into account as a form of asset management.

Table 8.1. Areas focused on in relation to the objective setting

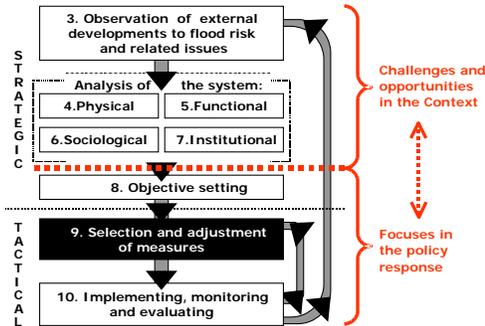
	England	Flanders	Nether-lands	Nieder-sachsen	Hamburg	Schlesw. Holstein	Denmark
Time horizon (needs of many generations)	●		●				
Economic costs and benefits taken into account	●		●			●	●
Ecological carrying capacity taken into account	●	●	●	●	●	●	●

● High focus level ● Moderate focus level

²⁴ Refer to COMRISK subprojects 2 and 4 for more information about risk assessment and risk expression.

²⁵ These are not listed here as they cannot be compared to other countries because of differences in hydraulic boundary conditions.

²⁶ The formal document containing the agreed upon objectives between ministry and agency is classified.



9 Selection of measures

In the previous chapter, the goals of the policy-makers have been described. In this chapter, we will look into the way these goals are achieved.

A methodology will be introduced to compare measures and the chosen measures will be compared. This will then be related to the policy-makers motivation for a certain strategy

Table 9.1 provides an overview.

Table 9.1 Overview table for measures

	England	The Netherlands	Flanders	Germany-Nieders.	Germany - Hamburg	Germany-Schl. Holst.	Denmark
Focus on intervention areas	Broad: (warning systems, defence works, spatial avoidance)	Defence works	Broad (defence works, evacuation, compensation)				
Focus on management instruments	Broad	Regulation and direct measures	Direct measures	Direct measures	Direct measures	Direct measures	Direct measures
Determining measures	Search for a combination of measures	Defence works as starting point	Search for a combination of measures				

9.1 Methodology for comparing measures

Mitigating the risk of flooding can be achieved with measures as diverse as building dykes and passing zoning legislation²⁷. Some classification is necessary to compare the countries. This will be done by introducing two aspects with respect to the measures:

- The point of intervention in the so called “safety chain” (from reducing probability to compensating for the actual damage);
- The type of management (regulation, communication, pricing, etc.).

Point of intervention

Instruments can be classified by their point of intervention: where in the chain of events from storm conditions to the actual damage do they intervene.

Management type

The second aspect of a measure is how the policy-maker tries to achieve the desired change in the system. An example of this could be ensuring that building work does not take place in flood prone areas through regulation (such as a zoning law forbidding building work) or communication (such as risk maps on the internet).

A classification is used in relation to this aspect of the instruments that has been derived from administration science. This classification distinguishes regulatory, economic (financial) and communication instruments²⁸.

The relevant government can achieve its objectives in society by convincing people (education, information) that certain behaviour is best, by enforcing certain behaviour through regulation²⁹ or by financially stimulating certain behaviour (subsidy, tax (cuts), tolls, etc.).

A fourth channel can be added in relation to the (partly) technical context: direct intervention (“do-it-yourself”). Otherwise it would be difficult to classify, for instance, the building of a dyke³⁰.

Combining the “where” and the “how to”

The combination of these two aspects relate to measures is illustrated in table 9.2. This table gives examples of measures policy-makers have chosen or considered.

We will compare countries in relation to the point of intervention as well as in relation to the channels they use for this (management instruments) in the next sections.

Table 9.2 Typology of measures

Point of intervention (where to...)			Management type (how to...)			
			Direct intervention	By regulatory instruments	By economic instruments	By communication instruments
R P E R D O U B C A N I B N I G L I T Y	Flood Protection Structures	Primary protection line	Build dykes, walls barriers, gates, etc.	Permits for activities related to sea defences. Spatial reservation for the future	Individual subsidies for shoreline properties	Building support for implementation of works
		Secondary protection line	Build secondary dykes. Improve road slopes/banks			
		Emergency repair of lines	Prepare for emergency repairs			
R C E O D N U S C E E Q U E N C E S	Flood resistant buildings		Supply sandbags	Building code	Subsidise home improvements. Arrange insurance discount	Encourage people to protect house by campaign, flood fairs etc.
	Avoid buildings in flood prone area		Buy properties and land at risk	Zoning laws, permits	Establish price signalling (insurance, house maps)	Risk maps. General awareness raising
	Crisis management	Forecasting and warning	Forecast and research centres. Measurement network	-	-	
	Recovery	Evacuation and Rescue operations	Emergency services, civil defence service, use of army			Emergency communication: Informing and instructing people what to do
		Regain land, restore infrastructure	Repair works to dykes, pumping Repair infrastructure			
COM-PENSATE	Redistribution of costs		Disaster funds. public insurance		Disaster funds, public insurance.	Communicate with insurers, promote insurance among people

9.2 Focus of selected measures by point of intervention

An overview of selected measures classified based on intervention point is depicted in table 9.3. in relation to the countries and regions involved. All countries use a combination of measures and regard coastal defence as crucial but differences exist in their focus. England and Denmark intervene in relation to a wide range of measures whereas Flanders, the Netherlands and Germany focus on their coastal defences.

Each of these intervention points will be discussed in the remainder of this section. To a certain extent, the management instruments to achieve them will also be discussed to ensure clarity.

Table 9.3 Focus of measures with respect to point of intervention

			England	Flanders	Netherlands	Niedersachsen	Hamburg	Schleswig-Holstein	Denmark
Reducing probability	Coastal Defence	Primary line	●	●	●	●	●	●	●
		Secondary line			.	.	.	.	.
		Prepare for emergency strengthening	.	.	.	.	●	.
Reducing consequences	Avoid building works in flood prone areas*		●		.	.	.	.	.
	Flood resistant buildings		●				.	.	.
	Crisis management	Forecasting and warning	●	●	●	●	●	●	●
		Evacuation and rescue operations	●	.	.	.	●	.	●
		Prepare to restore land and infrastructure	.						.
Compensating	Recovery	Redistribution of costs	●	.	.		.	.	●

● Used but limited and/or considered not important

● Used, considered of some importance

● Used, considered quite important

● Used, considered crucial

*) Netherlands, Schleswig-Holstein, Niedersachsen and Flanders only have restrictions on building work in the first (or first few) 100-metres of inland land. Denmark applies a larger zone due to landscape conservation considerations.

Reducing probability: primary coastal defence works

Coastal defences are important in all countries. The Dutch, Flemish and German coast is entirely protected by coastal defences; in England and Denmark, large parts (including urban areas) are protected.

Requirements related to the defences vary considerably in the UK. At some places, no more than a wall of a few feet is necessary whereas at other places high dykes (several meters in height) are necessary.

Most coastal defences are reinforcements (such as concrete protection) and nourishments of dunes in Flanders. Dykes and walls, however, also protect some parts. Currently, projects are planned to improve the defences in a number of urban areas in order to meet safety standard. These are complicated by the requirement not to block the view from the quay. Constructing defences with fewer slopes, which absorb the waves, will ensure views are not blocked.

Barriers and dams have shortened the coastline in the Netherlands in the 20th century. The Wadden Sea coast in the north is entirely defended by dykes. The Wadden islands have dunes on the North Sea side and dykes on the Wadden Sea side. The coasts in the Holland provinces consist mainly of dunes. Dykes, barriers, dams and some dunes protect the coast of the southern delta. A number of “weak links” have been identified recently that are planned to be reinforced. Sand nourishment is being implemented by national government as a temporary measure until the provinces have detailed comprehensive plans to deal with these situations. Some of these reinforcements have already been implemented in a large project in the Zeeland area.

The Niedersachsen main coastline is entirely dyked or dammed. Recently, the Ems barrier has been finished, which serves both as a protection and as a navigation measure. Several barriers are located at the tributary estuary rivers.

Hamburg is defended by walls and dykes. A few years ago a barrier was considered but in the end rejected. The main reasons for rejecting the option were the costs, reliability (will it close) and interference with navigation.

Schleswig-Holstein state dykes run along the entire main coastline. Improvements in the past have been the construction of a service road behind the dyke to ensure accessibility.

Dykes, some of which are being improved, defend the Wadden Sea area in Denmark. Some areas are not flood prone due to the higher land whilst other areas are more dune-like in the northern part of Jutland. These are at some points nourished for defence to ensure the inland areas are protected from flooding.

Dunes are important defence structures in Denmark, Germany (for the Wadden Islands), the Netherlands and Flanders. Dunes and beaches are also present in England. All of these regions face erosion problems. Erosion can take place gradually under normal hydrological conditions. If this is the case, there is no immediate link to safety because of flooding. During a storm, however, whole dunes can be swept away, which may cause safety problems.

All countries have changed over the last decades from hard structures to soft structures as the preferred way to prevent erosion and for flood defence. This has been a success. Flanders and the Netherlands only use hard measures if “soft” measures are not possible. Currently, there is a shift from beach nourishments towards nourishments of the foreshore.

Only the UK and Denmark have a policy (beyond the pilot stage) of “managed retreat” or “managed realignment”, which means that erosion will not be stopped at any cost.

Reducing probability: secondary coastal defence works

Secondary lines can be constructed in relation to large flood prone areas. In many cases they consist of (obsolete) polder dykes, former sea or river dykes and road and rail embankments. Often these secondary lines also function as defences against high river water levels.

The slope of the coast is mostly such in the UK that a secondary line would not be very useful. Secondary lines are, however, present behind barriers such as the Thames barriers.

Polder dykes and roads constitute secondary lines³¹ in Flanders and are considered in the strategy but there are no specific actions to maintain these as secondary lines.

Actively maintained secondary dykes exist in the Netherlands. These dykes run directly behind the primary dykes in the South (Zeeland area). They are meant as backup if the primary dykes slide due to instability. In addition, compartment dykes are present on the Zeeland islands. The use of secondary dykes is more limited in the Holland provinces. Old polder dykes (former Wadden Sea dykes) run in parallel to the present ones in the northern areas of the Netherlands.

National government is, however, mainly concerned with primary dykes for which they have a legal obligation. It is entirely up to the water boards to define policy for the secondary dykes. This is the reason why it has been specified as an intervention point of limited importance to national strategy in the overview table. These local authorities have also noticed a hazard related to secondary dykes: they can create deep areas with a small surface. If a primary dyke is breached, they can flood very quickly. On the other hand, large flood prone areas flood at a much slower rate.

Old polder dykes are present in Germany just as is the case in the northern part of the Netherlands. These are regarded as important since they provide robustness to the defence system especially in Schleswig-Holstein and Niedersachsen. The quicker flooding of the area between the primary and secondary line is regarded as a much lesser problem in Germany.

Reducing probability: emergency strengthening

Almost all countries have prepared for emergency strengthening during storm conditions of the dykes. Some of the Dutch interviewees did indicate that reaching the dyke, especially if breached, is very difficult; in particular, if we also take into account the extreme weather that is most likely at such times.

Danish policy-makers have an explicit policy not to repair the dyke during emergencies since it is considered that a greater threat to life (of workers) would be created when really protection is the aim.

Reducing consequences: avoiding settlement (population) and investments

Germany is mainly concerned with buildings that endanger the dyke within its direct vicinity. The Netherlands also avoids having buildings built in front of the dyke whereas in the UK buildings in front and behind the dyke are avoided.

There has been a relationship between spatial planning and flood risk for a long time in the UK. Currently, the UK uses a gradual approach in which several levels of flood risk are identified. No building work at all is considered to be the appropriate route for certain levels whilst hospitals and other emergency service accommodation provisions are deemed to be unsuitable at other levels.

An Internet map has been recently created which shows indicative flood plains. In short, a map depicting indicative levels of flood probability will also be published. In addition, the Environment Agency expects to be consulted by local planning authorities. Its advice is mostly followed although sometimes it is also ignored. The organisation that regulates solicitors has recently adopted a guideline to check for flood risk when in the process of buying a property through government encouragement.

An indirect effect that is unique to the situation in the UK is signalling of risk areas through the insurance and mortgage processes. If the risk is too high, insurance is not available. If insurance is not available, buyers may not be able to obtain a mortgage. On the one hand, this might be regarded as a problem but, on the other hand, it will ensure risk cannot develop further in certain cases.

The current Flemish government has not been given any powers to regulate developments on the basis of flood risk. This might be different in the future since the whole scope of coastal flood risk management will be revised.

Permits must be obtained to build or undertake any activity in the dune areas that are part of the sea defences in the Netherlands. People are not given a guaranteed protection level outside the protection zones as defined by legislation.

Enforcement of these permit regulations has largely depended on the vision of the provincial/regional/local authorities.

The Dutch government has recently undertaken action to better coordinate spatial planning and water management by introducing an obligatory “water test” in relation to land use decision procedures. The government also tries to more actively inform people and enforce regulation related to new building work. Direct mailing and displaying water board spatial zoning on municipality spatial zoning maps are two tools used for this purpose.

It is in general forbidden to live in front of the state dykes in Germany. Usually only a small strip of land will actually be in front of the dykes.

Reducing consequences: flood resistant buildings

England is the only region where the protection of buildings is regarded as an important measure in coastal flood risk management. Some have, however, noticed that too much protection increases the risk since floods may lead to excessively sealed houses collapsing. The government is involved in campaigning for awareness, organising flood fairs, direct mailing and sometimes even supplying sandbags.

There is regulation in place that covers minimum floor height with respect to flood risk in Denmark but this is regarded as less crucial when compared with the UK. Beach bars and restaurants must be temporary demountable structures and are not allowed during the fall and winter (the storm season) in the Netherlands. Water boards can also demand additional measures for buildings in specific areas.

Reducing consequences: forecasting and warning

All countries have set up strong structures for forecasting storm floods and determining if there is danger. The extent to which countries have organised information dissemination within the government departments and towards the public differs.

Forecasting and disseminating warnings is considered the most important intervention point in the UK. Contrary to most countries, warning the public is the responsibility of the national coastal manager (the Environment Agency). A number of tools have been developed to adequately issue warnings. These include displaying symbols on television programmes, warning sirens and automatic, massive dial-up systems to warn individual citizens.

A number of authorities is informed in Flanders when warnings need to be issued. There are specific warning arrangements in place to inform authorities in relation to floods.

Warnings are sent to authorities and can be found on the Internet but they are not actively disseminated to the public in the Netherlands. The warning of the public is general is left to disaster management authorities. There are no specific measures in place for the other issues; the general disaster warning bodies need to be used. Currently, Zeeland (as well as Essex in the UK) participates in the ESCAPE project to improve warning and evacuation methods.

Hamburg: Under the ‘S’ of Stormflut

Hamburg pays a lot of attention to evacuation preparation. This includes public dissemination of neighborhood evacuation plans.

This is performed by annually distributing information packs on a home-to-home basis and by including the information in the Hamburg Yellow Pages.

These plans indicate evacuation zones, zones that might flood partially, evacuation bus stops and shelter locations and shelter points if the warning time is too short to ensure proper evacuation.

National government prepares flood warnings for authorities in Germany which are published on the Internet.

The Hamburg government has its own flood forecast system and operates flood sirens. The DCA prepares flood forecasts and passes these on to the local authorities in Denmark.

Reducing consequences: evacuation and other rescue operations

Once a flood has occurred, the local authority is primarily responsible for disaster management (this may be up-scaled to higher authorities) in all countries. Disaster management authorities prepare specifically for flooding in some countries.

Local authorities are responsible for preparing a flood management plan in the UK. Some have done this in corporation with the Environment Agency while others have chosen not to make these plans.

Flood disasters are managed through general disaster management plans and structures in Flanders and most of the Netherlands. There are no specific plans that provide guidelines on how to deal with a large flood. The Netherlands is developing an evacuation simulation module as part of the FLORIS project. As well as being useful for reconsidering protection standards, these might also be used to prepare for and to manage flood disasters.

Reducing consequences: Recovery

Most countries have no plans in place that will help them recover from a flood. The province of Zeeland in the Netherlands does have “sleeping” contracts with contractors to restore dykes and other defences after a flood or dyke slide.

Compensation: Redistribution of costs

Once damage has occurred it cannot be undone. The costs related to material damage can, however, be redistributed amongst society. This can be done by the government (redistribution to the taxpayers) or by encouraging citizens to take insurance (redistribution over the pool of insured citizens).

In general, the interviewed policy-makers feel somewhat ambivalent towards compensation for damage. On the one hand, the feeling is that it alleviates the problems of individuals and can be more cost-effective than providing defence. On the other hand, it removes a very important incentive to avoid this type of damage. The exceptions to this are the UK and, in particular, Denmark, where a different attitude towards compensation exists.

Denmark: Combination of disaster fund and protection level

In Denmark rural flood-prone areas are protected up to a one in fifty years event. Damages of ‘severe’ storm floods are compensated from a disaster fund.

Usually damages incurred during storm floods that happen less frequently than 1:50 years (at a specific location), are compensated. In this way, although not formally, compensation and prevention measures complement each other around

Individuals can insure their property³² in the UK. The Association of British Insurers (ABI) plays an important role in relation to this issue. The ABI encourages its members to cover where reasonable flood risk. Recently, however, the increase in the damage caused and the stronger differentiation of premiums has put the current insurance system under pressure.

On the other hand, the UK is the only country where the government follows a strict non-compensation policy in relation to flood damage. Some of the interviewed experts did, however, notice that this is linked to insurability because otherwise government policy would be considered unacceptable by the general public.

Flanders has a national disaster fund that makes compensations for (parts of) the direct damage suffered by households. Compensation is allowed if an event is considered a disaster. In the 1993/1995 river floods, the disaster fund did make compensation for damages. New legislation, however, came into force in 2003 which stipulates that, in principle, private insurance must be taken to cover flood risk.

The Netherlands has a national disaster fund but as a rule saltwater floods (e.g. coastal flooding) are excluded from this. National government can, however, decide to open this fund in relation to saltwater flooding. The size of the fund (about 1 billion euros) is quite limited compared to the potential, maximum cumulative damage in the Netherlands (estimated at a hundred or even hundreds of billions of euros). Some of the interviewees did point out that, in practice, any threshold set in relation to flood compensation would be a very difficult issue in the Netherlands since there are strong societal feelings of solidarity when it comes to flooding which is also of great national importance.

No specific arrangements are made for compensation in Germany. Formally, the state has no responsibilities in relation to compensating for damage that may be caused. In practice, the decision is usually taken to make compensation after significant events at a political level.

Every Danish citizen is obliged to take flood insurance when taking general insurance. The premium for flood insurance is put into a special fund. Denmark, therefore, has in fact a flood disaster fund. The fund is opened if an event has been “severe” (for specific areas). Generally, events that occur less than once in fifty years are considered as severe.

9.3 Focus of selected measures by type of management

The measures have been described in the previous section based on their point of intervention in relation to the coastal system. This section will discuss the type of management system in place (method of steering) at a general level.

The differences between countries here are less distinct. In general, the UK uses more instruments to encourage action by citizens themselves whereas other countries rely more on action being taken by the government.

Direct intervention

Implementing coastal defence, operating forecast and warning services and emergency management are done in all countries by public organisations directly. The UK, however, not only contracts out specific construction and maintenance tasks but it also concludes contracts on a more general level (contract on service level).

Regulatory instruments

All countries / regions, except England, use regulation to control land use (see previous paragraph for details). Furthermore, regulation is used to protect dykes from damage. The Danish building code contains certain specific references to flood risk. Specific building policies for beach bars and restaurants exist in the Netherlands. Also water boards can demand additional measures for buildings in specific areas.

Economic instruments

Economic instruments, such as subsidies, are sparsely used. Subsidies are granted to companies to protect themselves in Hamburg. Insurance and natural disaster fund arrangements can be regarded as economic instruments to a certain extent.

Communication instruments

England: Activating the public

The English campaign “Flooding you cannot prevent it, but you can prepare for it” encourages the public to prepare themselves.

The latest advertisements include photos of flooded interiors with warnings such as that this means the end to your business if you are not insured or ask if you could still find your valuables in the dark if a flood happens.

An example of this can be seen in the Dutch “the Dutch live with water” campaign in which the need to support measures taken by the government is stressed.

The use of communication instruments is increasing in all countries although the purpose can be very different. In the UK, it is mainly used to improve the preparedness of the population regarding flooding and to improve actions during a flood whereas in the other countries it is mainly used to promote support during the implementation of defence works.

Netherlands:

Gaining support for works

The Dutch government has initiated a communication campaign to raise support for measures.

In commercials the public is explained that the climate is changing and that in order to keep the Netherlands safe, measures such as dike-strengthening, but also river meadow-widening are necessary.

9.4 Combining measures

Individual measures have been classified in the previous section. Policy-makers, however, have also been asked (and documents studied) what combination of measures they would prefer.

On a general level, there is a difference between the approach of the UK and Denmark, on the one hand, and that of other countries and regions, on the other hand.

Flanders, the Netherlands and Germany have coastal defences as their point of departure. They consider themselves in the first place responsible for these defences. *In addition* to this, they are also involved in other ways to reduce risk. Flanders is planning a shift to a broader approach. The outcome of the currently ongoing risk analysis project (FLORIS) might lead, in the Netherlands, to a broader approach.

The Danish and British authorities are also responsible for coastal defences but take this much less as a point of departure in relation to their strategy. They explicitly emphasise the need to find a combination of measures to best suit needs.

9.5 Areas focused on in relation to the choice of measures

The potential areas focused on in relation to measures have been derived from the ICZM criteria. They also relate to the organisation of flood risk management in certain respects.

The allowance of coastal dynamics is very much connected to erosion policy, which is outside the scope of this study. England allows largely for dynamics including the setting back of dyke lines. Some dynamics are allowed in Flanders, the Netherlands, Niedersachsen (for the Islands) and Denmark although, in general, the areas protected at the moment will remain protected. A retreat policy may be followed for the mainland in Germany in exceptional cases only.

The Niedersachsen's high-level policy is most strictly prescribing and local policy-making freedom is limited. Schleswig-Holstein's high-level policy-makers have provided the necessary freedom to the water boards with regard to the secondary dykes. Hamburg is itself an almost local authority and also provides the necessary freedom to industrial areas to arrange protection as they deem fit.

Denmark places much emphasis on the initiative and freedom of the counties and boards. Standards are set at a central level in the Netherlands and Flanders. Local tailor-made work is, however, receiving more and more attention. Alternatives to reach safety standards are discussed with local communities and municipalities.

England, Denmark and, to a slightly lesser extent, Hamburg use a variety of measures to achieve their objectives: allowing dynamics, forecast and warning, evacuation and coastal defence. Flanders, the Netherlands and the other German states concentrate mainly on coastal defence.

The Netherlands, though focused on coastal defence, is also more and more searching for multiple ways to arrange coastal defence.

Table 9.4 Areas focused on in relation to measures

	England	Flanders	Netherlands	Niedersachsen	Hamburg	Schlesw. Holstein	Denmark
Allowing dynamics	●	●	●	*			●
Allowance of local tailor-made solutions	●	●	●		●		●
Variety of measures	●				●		●
Variety of methods to achieve measures	●		●		●		●

*) Niedersachsen does allow the coastline to behave dynamically in relation to the Islands.

● High focus level ● Moderate focus level

²⁷ We define “measures” in this report as actions towards society taken by government to achieve objectives, which, in this case, are related to flood risk policy.

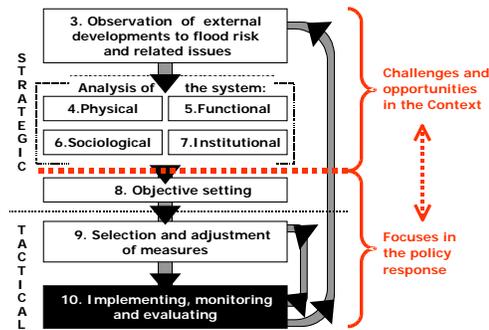
²⁸ According to Van der Doelen. Another axis in this model is stimulating/liberalising – limiting/sanctioning.

²⁹ Process regulation (for instance how decision-making should take place, which powers authorities have) is not considered in this method.

³⁰ This may be regarded as, for instance, an economic incentive granted to the firm carrying out the work but this would in fact deny that the government is acting as a private and not as a public party when tendering work.

³¹ Sometimes referred to as tertiary lines in Flanders where dykes behind dune interruptions are viewed as secondary.

³² (Very) large firms are able to insure themselves against flooding in these countries. Even in the Netherlands, some very large firms are covered against flood damage.



10 Implementing, monitoring and evaluating

We will briefly look at experience the countries have gained in relation to the implementation, monitoring and evaluation of their policy in this section.

COMRISK subproject 4 specifically deals with indicators for monitoring and evaluating purposes.

10.1 Implementations and hurdles to implementation

Much of the implementation organisation and many of the issues have been discussed already in part B of this report. We will discuss the main issues related to implementation and how these are managed in this section.³³

The public is sometimes concerned in the UK with the denial of national government grants because a proposal for flood defence works does not rank highly enough. Another point of discussion is how to deal with ecological sensitive areas.

The main problems regarding implementation are disturbance due to the works and the aesthetics of the measures in Flanders. The government tries to overcome these barriers by dialogue with the public and by designing defences in such a way that they improve safety as well as being aesthetically pleasing or having a recreational use (for instance wider beaches or sloped defences instead of a high wall).

Similar problems exist in the Netherlands. Here the main concern is a perceived lack of support for expansion of defences due to, for instance, homes having to be demolished. The Dutch national government tries to overcome this through public communication campaigns and by increasing coordination within national government and towards lower government departments.

The implementation of the Ems barrier provoked much discussion recently in Niedersachsen. In general, the Niedersachsen government tries to avoid conflicts by early involvement; this, however, is not always successful. In the Ems barrier case, the parties ended up in a series of court cases, which the government eventually won.

The limiting factor in the level of protection is national level funding in Hamburg. Hamburg has tried to overcome this by trying to obtain funding from the European Union and increasing the city's budget. No major implementation barriers have been found in the literature or during the interviews in Schleswig-Holstein and Denmark.

10.2 Monitoring the performance of measures

Different monitoring systems exist for different measures in the UK. The success of communication campaigns is measured by frequent surveys; there are reports on the number of recommendations issued by the Environment Agency on flood risk and developments (and how many are followed).

A monitoring system for the performance of dykes is being developed. This includes a quick grading mechanism in relation to the state of the dyke and the crest level.

Since Flemish policy-makers are currently only involved in coastal defence, monitoring activities are also limited to this. The monitoring of the coastline and the calculation of storm setback lines plays an important role.

In the Netherlands, a 5-year cycle of assessment of dykes has been set up of which the first cycle has just been completed. Dykes are examined to check whether they still meet legal standards in this assessment. Hydraulic boundary conditions are also reviewed every five years.

The biannual inspection of dykes has a traditional and communications role (see the frame) in Germany but is foremost an instrument to assess the state of dykes and determine any necessary work that needs to be carried out.

Germany: Walking the dykes

A long and old tradition in German states is the formal inspection of the dykes twice a year. Groups of representatives from the ministry, water boards, Environment Agency, local government and the army inspect dykes by walking or driving over them and meanwhile discussing the condition of the dykes.

Besides having a technical function, they have a strong communicative function beyond the group itself: the media covers these inspections and their outcome.

A more extensive evaluation, such as the review of the hydraulic boundary conditions, is triggered by new insights from studies made by the NLWK, the universities or the Bezirke in most areas of Germany. This is being done on a more periodic basis in Schleswig-Holstein. Their system is similar to the system in place in the Netherlands: every ten years a full assessment is carried out.

In Denmark, the prime responsibility resides with the counties. The Danish Coastal Authority, however, monitors the North Sea and Wadden Sea dykes and reports if they do no longer meet safety standards. Each five years a full assessment is carried out.

The Netherlands: 5-yearly assessments

After the 1993/1995 near flooding of the main rivers, a system has been set up to monitor whether dykes meet legal standards.

National government has set the guidelines and has developed the necessary tools. The water boards (and sometimes regional offices of the ministry) carry out the inspection and the calculations and report back to the provinces. The provinces report the results obtained by the water boards in their province to the ministry.

The first round of inspection has just been completed.

10.3 Reconsidering the set of measures

The extent to which countries reconsider their policies and the accompanying measures (for instance considering avoiding building work instead of providing defences) varies.

Some countries and regions take certain measures as their starting points while other countries and regions are more open to all options.

The UK does not have a fixed starting point for policy. In setting new policies, the experiences with the current measures are considered and examined in the light of alternative scenarios.

Policy scope has been relatively narrow and focussed on coastal defence in the past in Flanders. Flanders, however, is now planning to come to an approach in which a variety of measures is used.

In the Netherlands, the general approach towards flood risk management has been discussed by, for instance, the committee for water management in the 21st century but also when preparing new policy documents for the coast. This resulted in increased attention being paid to spatial planning.

The basic strategy of focusing on defences is not extensively reconsidered in Germany while Denmark uses a variety of instruments but has not recently reconsidered whether a different set should be used. The current set of measures is generally regarded as quite close to an optimal solution.

United Kingdom: new national strategy

In the UK a new national strategy is currently being prepared: 'Space for Water'.

This new strategy may imply a change in targets and selected instruments compared to what is being described in this report.

10.4 Areas focused on in relation to implementing, monitoring and evaluating

All countries try to improve their actions by learning about their performance. Only a few countries and regions are reconsidering their general set of measures (or have done so recently).

Table 10.1 Areas focused on in relation to monitoring and evaluating

	England	Flanders	Netherlands	Nieder-Sachsen	Hamburg	Schlesw. Holstein	Denmark
Performance monitoring of measures	●	●	●	●	●	●	●
Reconsideration at a strategic level	●	●	●				

● High focus level ● Moderate focus level

³³ Refer to subproject 2 (strategic planning) of COMRISK for more information.

Part D Synthesis

11 Conclusion and recommendations

First, the challenges and policy focus areas identified in the sections above will be recapitulated in section 11.1 in the present section. Next, the relation between context and policy will be discussed. We end this report by giving a few recommendations for future activities.

11.1 Overview of challenges and policy focus

Table 11.1 is a synthesis of the figures shown in the previous section. As explained in section 2, this is not a standardising figure: more dots in relation to policy assessment indicate more identified challenges or a strategy which includes a variety of areas on which the focus has fallen.

At a glance, it is clear that each country faces its own set of challenges and has its own set of areas on which it focuses although the countries do share a considerable number of challenges and areas on which they focus.

Challenges in the context

The external developments are largely similar: a concern about climate change and increasing regulation with respect to the environment. England, Flanders and the Netherlands also face a demand to allow spatial development.

The scale of the potential flooding differs greatly. At one extreme, we have Denmark with only a few low-lying areas where people live and, at the other extreme, we have the Netherlands where most economic investments and the majority of people are located in potential flood prone areas. Almost all countries do have in common that many stretches of their coasts are nature areas with a specific status (Natura 2000).

The amount of available funding is a limiting factor for all countries or is expected to become limiting in the future. The challenges in the organisation of flood risk management have a more ambiguous character. Relationships with disaster management organisations and/or spatial planning organisations are not always present but this is generally not regarded as a problem.

Areas focused on in relation to defining policy

All countries must deal with common regulation imposed by the EU to ensure the ecological impact is taken into consideration. The extent to which economic effects are assessed varies greatly. In the UK, for instance, it is a central element in the appraisal of projects. In Germany, the deterministic approach and demand for equity leads to economics playing a minor role. Flanders, the Netherlands and Denmark, in principle, do want to consider economic effects and are currently in the process of making or updating cost-benefit analyses.

Two types can be identified in relation to the measures countries have chosen to manage risk: a broad approach (the UK and Denmark) and a more focussed approach on coastal defences (Flanders at present, the Netherlands and Germany).

All countries are involved in refining and improving their measures. The general strategy, however, is only being reconsidered in a few countries.

Table 11.1 Assessment overview

		Engl.	Fland.	Netherl.	Nieders.	Hamb.	Schl.H.	Denm.
Challenges	External Developments	Relative sea level rise	●	●	●	●	●	●
		Ecological regulation	●	●	●	●	●	●
		Pressure for development	●	●	●	●	●	●
	Physical	Large amount of flood prone area	●	●	●	●	●	●
		Deep flood prone areas	●	●	●	●	●	●
		Natural coastline offers little protection	●	●	●	●	●	●
	Functional	Major cities threatened	●	●	●	●	●	●
		Designated nature areas	●	●	●	●	●	●
	Sociological	Low sense of urgency citizens	●	●	●	●	●	●
	Institutional	Limited staff capacity	●	●	●	●	●	●
		Limited budget	●	●	●	●	●	●
		Limited relation to disaster man policy		●	1			
		Limited relation to spatial plan. Policy		●	●			
		Limited vertical integration.	2		●			
	Focus in policies	Risk judgement and goal-setting	Time horizon (needs of many generations)	●		●		
Economical costs and benefits taken into account			●		●		●	●
Ecological carrying capacity taken into account			●	●	●	●	●	●
Measures		Allowing dynamics	●	●	●	3		●
		Allowance of local tailor-made solutions	●	●	●		●	●
		Variety of measures	●		●		●	●
		Variety of methods to achieve measures	●		●		●	●
Monitoring and evaluation		Performance monitoring of measures	●	●	●	●	●	●
		Reconsideration at strategic level	●	●	●			

● Challenge / focus point

● Major challenge / major focus point

11.2 Relation between context and policy

A distinction has been made between context (part B) and policy (part C) in this study.

Each government has to manage within a certain context. The context is made up of several factors that the policy-maker cannot directly influence such as the climate change, the historical setting and public attitude towards the government. In assessing the context, we have analysed which challenges the policy-makers face. We have also analysed policies for coastal risk management. We can conclude that the form in which coastal risk management is implemented differs depending on the socio-economic and socio-cultural setting.

The relation between context and policy has been extensively discussed with the interviewees and the members of the COMRISK project team. Although the relation between context and policy is hard to quantify, we can conclude that policy largely depends on context elements such as the history of flooding, the cultural, socio-economic and institutional setting, public awareness, et cetera. At the same time, this does not necessarily mean that policy cannot be influenced or changed.

This brings us to the conclusion that within each country specific context policy-makers have a certain degree of policy freedom. This degree of freedom depends on several factors such as the available mandate or authority, the current political agenda, the need for change, the budget, public support, etc.

This can be explained with an example. Once we compare the context of the port of Rotterdam with the port of Hamburg, we see that although the context is quite similar (sea port at a main river, large economic value), the chosen measures differ (storm surge barriers and dykes versus (private) dykes and walls and evacuation plans).

This also implies that countries can learn from each other. We have found several differences between the countries. We have, for instance, seen that the UK and Denmark have more variety in measures than the Netherlands, Germany and Flanders. This offers opportunities and challenges in relation to exchanging experiences and information and in adopting part of each other policies, strategies, measures or instruments within the region-specific context.

Elements that seem interesting in particular in this respect include: public awareness in relation to responsibility when it comes to take action (government versus individuals taking action), insurance versus compensation and evacuation and crisis management.

11.3 Recommendations

The objective of COMRISK is to improve coastal flood risk management through a transfer and evaluation of knowledge and methods as well as pilot studies. This subproject has provided a comprehensive analytic framework as a tool to assess policies and strategies for the five regions. The analytic framework has proven to be an adequate tool for gaining insight in coastal risk management as applied in the North Sea Region. It is used to assess current national policies in terms of legal, social, technical, financial, socio-economic, ecological and managerial aspects. The framework can also benefit future policy analysis.

This COMRISK subproject has contributed in assessing and comparing current policies and strategies. We are convinced that the countries and regions have already benefited from this study by sharing information and experiences and by contributing to several discussions. Nevertheless, several authorities and key players have expressed their desire to learn more from each other and possibly adopt each others' instruments or even achieve common strategies. Although one could argue that serious difficulties will be involved in establishing common strategies for coastal flood risk management, we conclude that defining common policies and strategies is a major challenge and opportunity for obtaining improved coastal flood risk management.

This could be done by:

- Establishing a partnership which stimulates knowledge exchange between the countries and regions regarding the themes mentioned above. The current North Sea Coastal Managers Group could perform this activity.
- Strategy development, where deemed desirable, by forming partnerships in relation to specific strategies and measures. This holds in particular for the following themes: public awareness in relation to responsibility for taking action (government versus individuals taking action), insurance versus compensation and evacuation and crisis management,

Defining common strategies and policies does not necessarily have to lead to harmonisation. Although future harmonisation of policies and strategies should not be avoided when they are desirable and feasible, we believe that policy-makers have to focus on further mutual understanding and mutual learning.

Annexes

A. List of documents

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B. List of interviewed partners

Name	Organisation
Mr Allinson and Mr Riby	Special interest group for the coast, Local Government Association
Mr Brook	UK Office of the Deputy Prime Minister
Ms Christensen	Danish Environment Ministry, Forest and Nature Agency
Mr Debyser	Cabinet of the governor of West-Flanders
Ms Erenstein	National Institute for Coastal and Marine Management, Dutch Department of Transport, Public Works and Water Management (RIKZ)
Mr Frew	District Council of North Norfolk, Chairman of the Anglian Coastal Group and chairman of the review commission of the funding structure
Mr Green	Flood Hazard Research Centre, Middlesex University
Mr Heldens	“Zeeuwse Eilanden” water board
Mr Van der Hoek	Section Safety, Directorate General Water, Dutch Department of Transport, Public Works and Water Management
Mr Jensen and Mr Nielsen	Local dikeboard/Ribe Region
Mr Lange and Mr Osthorst	University of Bremen
Mr Laustrup	Kystinspektorat (Danish Coastal Authority)
Mr Lübbe	Referat 412, Verbraucher department, Federal government of Germany Berlin
Mr Meadowcroft	UK Environment Agency
Mr Noosten and Mr Oldewürtel	Dyke Board Norden
Mr Thorenz	Niedersächsischer Landesbetrieb für Wasserwirtschaft und Küstenschutz (NLWK)
Mr Otto	City-state of Hamburg
Mr Probst	Küstenschutz, Innenministerium Schleswig-Holstein
Mr Van Rooy	Accanto
Mr De Rouck	University of Gent
Mr Richardson	Department for Environment, Food and Rural Affairs
Mr Thissen	Delft University of Technology, Faculty Technology Policy and Management
Mr Verwaest	Coastal and water division, Ministry of the Flemish Community
Mr Wenn	Bezirksregierung Weser-Ems
Mr Westerhoven	Province of Zuid-Holland