Bridging boundaries

Making scale choices in multi-actor policy analysis on water management

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Ithaka

*As you set out for Ithaka hope your road is a long one,
full of adventure, full of discovery.
Laistrygonians, Cyclops, angry Poseidon - don't be afraid of them:
you'll never find things like that one on your way
as long as you keep your thoughts raised high,
as long as a rare excitement
stirs your spirit and your body.
Laistrygonians, Cyclops, wild Poseidon - you won't encounter them
unless you bring them along inside your soul,
unless your soul sets them up in front of you.*

*Hope your road is a long one.
May there be many summer mornings when,
with what pleasure, what joy,
you enter harbours you're seeing for the first time;
may you stop at Phoenician trading stations to buy fine things,
mother of pearl and coral, amber and ebony,
sensual perfumes of every kind -
as many sensual perfumes as you can;
and may you visit many Egyptian cities
to learn and go on learning from their scholars.*

*Keep Ithaka always in your mind.
Arriving there is what you're destined for.
But don't hurry the journey at all.
Better if it lasts for years,
so you're old by the time you reach the island,
wealthy with all you've gained on the way,
not expecting Ithaka to make you rich.*

*Ithaka gave you the marvellous journey.
Without her you wouldn't have set out.
She has nothing left to give you now.
And if you find her poor, Ithaka won't have fooled you.
Wise as you will have become, so full of experience,
you'll have understood by then what these Ithakas mean*

Constantinos Kavafis (1911)

In: C.P. Cavafy, Collected Poems. Translated by Edmund Keeley and Philip Sherrard. Edited by George Savidis. Revised Edition. Princeton University Press, 1992

Preface and acknowledgements

This thesis synthesizes different perspectives on scale choices (spatial boundary setting, temporal boundary setting and the selection of the level of aggregation) in policy analysis. Scale choices influence the content of a study: the problems on the agenda, the options found and the impacts addressed. This also affects the process because scale choices are not politically neutral: they may advantage or disadvantage certain actors by putting their urgent problems, their preferred options on the agenda and may hide or stress the positive or negative impacts of options. In my opinion, it is important to pay sufficient attention to scale choices in the design of a policy analysis process because they have a large influence on the policy analysis process and its outcome.

Yet, little is known about the specific effects of the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation and how they are made in practice. In this research, the making of scale choices is studied using two empirical cases: the Long-Term Vision of the Scheldt Estuary and the Water Shortage Study of the Netherlands. Scale choices appear to be an important framing instrument that can be used by policy analysts. Only a relatively small group of people calls themselves policy analysts. However, a large group of people perform policy analysis processes without labelling themselves policy analysts: often governmental officials occupied with preparing policy documents. I hope that policy analysts in the broad meaning of the word consider this thesis useful in making decisions in the design of a policy analysis process, maybe even in a broader context than making scale choices. I hope that experienced policy analysts recognise the importance of the problems addressed in this thesis, and that it makes their relevant tacit knowledge explicit and accessible to others. Also, I hope that other readers of this thesis understand what a challenging endeavour policy analysis is: balancing on a thin line in the gap between politics and scientific research.

I would like to use this opportunity to thank many people who have been of vital importance during this research and writing process.
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were right: *De kunst van het afronden van een proefschrıft is niet om de puntjes op de i te zetten, maar om er een punt achter te zetten.*
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To all the friends of the *Mijnbouwgroep*, thanks for the social distraction during the weekends, the Christmas dinners and the ladies' dinners: I think it is really special to undertake these kinds of activities with such a large group of friends. I hope we can keep doing so even now that more and more little miners are giving *acte de presence*.

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Table of Contents

Preface and acknowledgements vii
Summary 1
1. Problem formulation and research approach 9
1.1. What are scale choices? 9
1.2. Scales and scale choices in policy analysis in water management 13
1.3. A quick scan to explore the problem 15
1.3.1. Introduction 15
1.3.2. Exploring the theory 16
1.3.3. Exploring the practice 17
1.3.4. Conclusions 19
1.4. Research questions and objective of study 19
1.5. Research approach and structure of the thesis 20
2. Policy analysis: the edge of reason 25
2.1. Preview of the chapter 25
2.2. Defining policy analysis 25
2.3. Developments in policy analysis 27
2.3.1. Policy analysis in the early years 27
2.3.2. A shift in policy making 28
2.3.3. From single actor to multi-actor policy analysis 29
2.3.4. Overview of differences 31
2.4. An overview of goals in policy analysis 32
2.5. Different rationalities in policy analysis 35
2.5.1. The concept of rationality in policy analysis 35
2.5.2. Scientific rationality 37
2.5.3. Political rationality 38
2.5.4. Managerial rationality 40
2.5.5. Design rationality 40
2.5.6. Overview of the rationalities 42
3. Scale choices in policy analysis on water management 45
3.1. Preview of the chapter 45
3.2. Definitions 45
3.3. Scale-related trends in water management 48
3.3.1. Global scales and cross-scale interactions 48
3.3.2. Small is beautiful 49
3.3.3. Mismatch in physical and institutional scales 49
3.3.4. Responses to the mismatch 50
3.4. Scale according to different rationalities 53
3.5. Scale according to the scientific rationality 54
3.5.1. System scales 54
3.5.2. Scales in sciences related to the physical system 56
3.5.3. Scales in sciences related to the human system 60
3.5.4. Scale choices in integrated water management research 61
3.6. Scale according to the political rationality 63
3.6.1. Decision making scale 63
3.6.2. Strategic behaviour related to scale 64

3.6.3. Process related chances offered by scale 66
3.7. Scale according to the managerial rationality 66
3.8. Scale according to the design rationality 67
3.8.1. Introduction 67
3.8.2. Observation scale 68
3.8.3. Analysis scale 71
3.8.4. Presentation scale 75
3.8.5. Upscaling and downscaling 76
3.9. Overview of scale choices and views on scale choices 77
4. Conceptual model and case study research approach 81
4.1. Preview of the chapter 81
4.2. Conceptual model 81
4.2.1. Introduction 81
4.2.2. Actor views on scale alternatives 82
4.2.3. Description of the actor archetypes 86
4.2.4. Scale decision making 88
4.2.5. Effects of scale choices 89
4.2.6. Use of the conceptual model 89
4.3. Selection of cases 90
4.4. Data collection 93
4.5. Data analysis 95
4.5.1. Overview of steps in analysis 95
4.5.2. Analysis of the selected scale and thought experiment 96
4.5.3. Summary of the major dilemmas 100
4.5.4. Analysis of effects of the selected scale choice 100
4.6. Structure of presentation of case study results 101
4.6.1. Overview of presentation 101
4.6.2. Presentation of case study descriptions 102
4.6.3. Presentation of case study analysis 103
5. Case description of the Long-Term Vision of the Scheldt Estuary 105
5.1. Context 105
5.1.1. Background 105
5.1.2. Problem situation 105
5.1.3. Actors involved 107
5.2. Policy analysis process 109
5.2.1. Assignment 109
5.2.2. Objectives 109
5.2.3. Project approach 111
5.2.4. Organisation 112
5.3. Scale decision making 114
5.3.1. Spatial boundary setting 114
5.3.2. Temporal boundary setting 119
5.3.3. Selection of the level of aggregation 122
5.4. Scale handling during the process 125
5.5. Results 128
5.6. Aftermath 129
6. Case description of the Water Shortage Study 133
6.1. Context 133
6.1.1. Background 133
6.1.2. Problem situation 137

6.1.3. Actors involved 139
6.2. Policy analysis process 140
6.2.1. Assignment 140
6.2.2. Objectives 141
6.2.3. Project approach 142
6.2.4. Organisation 143
6.3. Scale decision making 146
6.3.1. Spatial boundary setting 146
6.3.2. Temporal boundary setting 148
6.3.3. Selection of the level of aggregation 150
6.4. Scale handling during the WSS-project 154
6.4.1. Spatial boundaries 154
6.4.2. Temporal boundaries 156
6.4.3. Level of aggregation 158
6.5. Results 160
6.6 Aftermath 162
7. Studying the effects of the spatial boundary setting 163
7.1. Introduction 163
7.2. Long-Term Vision of the Scheldt Estuary 164
7.2.1. Analysis of the selected spatial boundaries 164
7.2.2. Thought experiment 167
7.2.3. Summarising the major effects of the selected spatial boundaries 182
7.2.4. Concluding remarks 184
7.3. Water Shortage Study 187
7.3.1. Analysis of the selected spatial boundaries 187
7.3.2. Thought experiment 189
7.3.3. Summarising the major effects of the selected spatial boundaries 196
7.3.4. Concluding remarks 198
7.4. Cross-case comparison 200
8. Studying the effects of the temporal boundary setting 203
8.1. Introduction 203
8.2. Long-Term Vision of the Scheldt Estuary 204
8.2.1. Analysis of the selected temporal boundaries 204
8.2.2. Thought experiment 207
8.2.3. Summarising the effects of the selected temporal boundaries 211
8.2.4. Concluding remarks 213
8.3. Water Shortage Study 215
8.3.1. Analysis of the selected temporal boundaries 215
8.3.2. Summarising the effects of the selected temporal boundaries 219
8.3.3. Concluding remarks 220
8.4. Cross-case comparison 222
9. Studying the effects of selection of the level of aggregation 225
9.1. Introduction 225
9.2. Long-Term Vision of the Scheldt Estuary 227
9.2.1. Analysis of the selected level of aggregation 227
9.2.2. Summarising the effects of the selected level of aggregation 230
9.2.3. Concluding remarks 233
9.3. Water Shortage Study: modelling 234
9.3.1. Analysis of the selected level of aggregation 234
9.3.2. Thought experiment 236

9.3.3. Summarising the effects of the selected level of aggregation 238
9.3.4. Concluding remarks 240
9.4. Water Shortage Study: presentation of the results..242
9.4.1. Analysis of the selected level of aggregation 242
9.4.2. Summarising the effects of the selected level of aggregation 247
9.4.3. Concluding remarks 248
9.5. Cross-case comparison...249
10. Conclusions, recommendations and reflection 253
10.1. Preview of the chapter..253
10.2. Role of scale choices in policy analysis processes 254
10.2.1. What perspectives on scale choices exist in general? 254
10.2.2. What are the specific effects of scale choices?..254
10.2.3. What challenges play a role in the making of scale choices?............................258
10.3. Scale choices as a framing instrument: design of framing guidelines......................259
10.4. Ten recommendations for the process of making scale choices...............................263
10.5. Reflection on the approach...271
10.6. Reflection on the actors' roles 274
10.7. Contribution of the research and suggestions for future research 277
10.8 Closing remarks 279
References..281
Appendix 1 Questionnaire quick scan 291
Appendix 2 Policy analysts interviewed in the quick scan 293
Appendix 3 Actors interviewed in the case studies..294
Appendix 4 Question list used as a basis for the interviews 295
Appendix 5 Score cards for the spatial boundary setting 296
Appendix 6 Score cards for the temporal boundary setting 301
Appendix 7 Score cards for the selection of the level of aggregation...........................303
Nederlandse samenvatting 307
Curriculum Vitae..315

Summary

Bridging Boundaries:
Making scale choices in multi-actor policy analysis on water management

1. Problem, objectives of study, research approach, and contribution of the research

Processes in water management operate on different scales, both in space and in time. Spatial scales vary from a global scale at which the changes in the fluxes of precipitation, evaporation and change under influence of the global warming play a role to a local scale such as the water balance in a municipal area. Also interactions between the different scales exist. Time scales vary from many years for slow processes, such as the diffusion and dispersion of contaminants in the groundwater, to a few days for highly dynamic processes, such as the river discharge to the sea. Because of this large variety in scales, many actors at different scales are involved in water management issues, like river basin organisations, national governments, regional governments, water boards and municipalities.

Water management policy processes can be supported by policy analysts. They can support the policy-making process by gathering, integrating and structuring information, and by facilitating a multi-stakeholder debate. In the design of every policy analysis process, boundaries for space and time have to be set. Also, the level of detail to be used has to be determined. These choices are called *'scale choices'*. Examples of important scale-related questions are: At what scale are the problems going to be defined and studied? At what scale are policy options to be designed? At what scale are the effects assessed and the results presented? Because water management issues play at such a wide range of spatial and temporal scales in policy analysis processes in water management, many alternative scale choices exist and this adds to the complexity.

The spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation are also complex due to the lack of uniformity in terminology, the presence of multiple perspectives, and the lack of insight into the possible effects. In a policy analysis process, scale choices are crucial because the adoption of a particular scale in space and time and the level of aggregation determine for a large part the types of problems that can be addressed and the problems that fall outside the scope, the kinds of solutions that can be found and the solutions that fall outside the scope, and the effects that will be evaluated. Scale is not politically neutral. Scale choices have a strategic value because the selection of scale may - intentionally or unintentionally - privilege certain stakeholders at the expense of others. In policy analysis processes, often a lot of actors with different (or even conflicting) interests at different scales may be involved, and the selected scale will privilege actors whose problem or interests becomes manifest at the scale selected. No ideal scale exists because all options for scale choices have advantages and disadvantages, not only for actors with specific interests but also on a more general project level. Consequently, scale choices entail dilemmas and difficult trade-offs.

Although making scale choices is difficult and has important consequences, little theory and no guidelines are available on how to make and handle these choices in policy analysis. A clear distinction is made in this study between the *making* of scale choices and the *handling* of them. Making scale choices is defined as the decision process that leads to the scale choice, while the handling deals with how the scale choice is dealt with during the policy analysis process after the choice has been made. Is it adjusted, neglected, strictly used or handled in a flexible way?

Two main research objectives result from the problem analysis:
1. Provide insight into the role of scale choices (spatial boundary setting, temporal boundary setting and the selection of the level of aggregation) in policy analysis processes on water management
2. Provide guidelines/ recommendations for the making of scale choices in the design of policy analysis processes in such a way that they contribute to the success of a policy analysis.

Because little is known about making and handling scale choices in policy analysis in theory and practice, this research has an *exploratory* character. The first part consists of a literature study in which a conceptual framework of the important aspects is developed. The literature study also provides insight into the rationalities that play an important role when studying scale choices and helps to structure this problem of making scale choices.
The second part of the research consists of two case studies in which the making and handling of scale choices is studied in practice by interviewing actors involved, observing the process of study, and by analysing available project documents and secondary literature.

2. Rationalities and scale in policy analysis

This research recognises the multi-actor context of policy analysis. This is done without compromising the rational, goal-oriented and analytical nature of policy analysis and the dilemmas that result from multiple goals and competing values. In this thesis, four rationalities in policy analysis are distinguished that are helpful in the analysis of scale choices and their effects:

- Scientific rationality
- Political rationality
- Managerial rationality
- Design rationality

These four rationalities differ not only in their perspective on policy analysis but also in the way scale choices are regarded. In the *scientific rationality*, the key attributes of the system under study should play an important role in the making of scale choices, especially in the disciplines that are related to the fysical system. In various disciplines, different views on scales exist. A geologist, for example, looks, by nature, at a much longer time scale than an economist because of the different temporal scales of the processes that play a role in their disciplines. So, from this perspective, scale choices are not regarded as free choices but as a system-related characteristic: the system scale. Physical, social, political and economic systems have characteristic spatial and temporal scales. As these scales vary significantly, different scientific disciplines may hold different opinions on what is the appropriate system scale.

In the *political rationality*, scale choices are regarded as a social construct. Social constructs are human choices rather than laws resulting from nature. Also, scale choices are often seen as an instrument that can help to achieve one's objective. Scale choices can be a means of inclusion or exclusion not only regarding the content of the study: the actors involved depend on the scale that is selected. New actors may enter the process while other actors may exit when scale choices are changed. In the political rationality, multi-stakeholder interests can be distinguished that result in different views on scale.
In the *managerial rationality*, practical limitations, like the available time and budget, play an important role that may decrease the number of feasible options for scale choices. In this rationality, scale is regarded as a management instrument to scope the project and define what is included and (preferably) what not. In order to be able to finish a study on time and within budget a balance is needed between scale (extent) and detail. Studies that combine large boundaries with a low level of aggregation usually require a lot of time and a bigger budget.
According to the *design rationality*, different decisions related to scale have to be made in a policy analysis process. In the design rationality, three dimensions of scale choices are distinguished: the observation scale, the analysis scale and the presentation scale. These choices have close relationships to each other and therefore cannot be selected independently from each other. These dimensions play a role in the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation.

In the making and handling of the spatial boundary setting, temporal boundary setting and the selection of the level of aggregation, four scale-related challenges can be recognised that are related to these four rationalities:

1. Dealing with multi-disciplinary views on scale: How to deal with different disciplinary views and how to link data and models from different disciplines? This challenge is related to the scientific rationality.
2. Dealing with multi-stakeholder interests that are related to scale: How to handle the multi-stakeholder interests in a way that does justice to all the interests involved? This challenge is related to the political rationality.
3. Making scale choices in such a way that they contribute to an efficient achievement of objectives within the boundary conditions. This challenge is related to the managerial rationality.
4. Handling scale discrepancies between models and policy questions: Often, big differences appear to exist between the scale of the available data and models and the required presentation scale. This challenge is related to the design rationality.

Table 1 gives an overview of the characteristics of these rationalities, their views on policy analysis and the scale-related challenges.

Policy analysts have a dominating design rationality but also a combination of the other rationalities. They make the connection between the rationalities by switching between the different rationalities. To do so, they often play a different role when they communicate with people from different rationalities: so, when acting in the policy process the policy analysts often take on a scientific rationality and when acting in the research process they often take on the political rationality or a managerial rationality.

Table 1: Different rationalities playing a role in making scale choices in policy analysis (findings based on this thesis)

	Scientific rationality	**Political rationality**	**Managerial rationality**	**Design rationality**
View on policy analysis	Policy analysis is research	Policy analysis is a process	Policy analysis is a project	Policy analysis is an artefact
Role of the policy analyst	Knowledge integrator	Facilitator/ mediator	Project manager	Creator/ designer
Key challenge	Providing the policy process with scientifically valid knowledge	Handling multi-stakeholder interests	Pragmatism in dealing with objectives and constraints	Creating functionality: an actionable form to promote valued outcomes in a particular context
Key goal	Creation of knowledge and truth	Protection of interests	Efficiency	Policy relevance
Dominant view on scale choices	Scale as a system-related characteristic	Scale as a social construct; an instrument to get what you want	Scale as a scoping instrument	Scale as design decisions
Scale related challenge	Dealing with multi-disciplinary views on scale	Dealing with multi-stakeholder interests that are related to scale	Making scale choices that contribute to an efficient achievement of objectives	Handling scale discrepancies between models and policy questions

3. Case studies

Two policy analysis processes were analysed to study the making and handling of the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation and their effects in practice: the Long-Term Vision of the Scheldt Estuary (LTV) and the Water Shortage Study of the Netherlands (WSS). In both processes, multiple objectives of study existed and numerous actors were involved that operated on different spatial scales. The case studies were executed by conducting interviews and studying project documents and related literature. Four archetypical views were used in the case studies: political actor, commissioner, policy analyst and researcher. The rationalities as such are useful as an underlying concept, but not as an instrument for categorisation in practice because actors may have a combination of different rationalities. Therefore, so-called ‘archetypical views’ have been determined that are characterised by similar rationalities (and sometimes a combination of rationalities) and perceptions on a policy analysis process. The typology of actor archetypes aims to provide a classification structure that gives insight into the views of these archetypes on scale choices. Also, it helps to understand their different ways of thinking.

Long-Term Vision (LTV) Study of the Scheldt Estuary

In the LTV, the deepening of the Scheldt was a very controversial issue in which many actors with conflicting interests were involved. The question that is addressed is how the spatial boundaries contributed to placing the deepening issue central on the agenda. The temporal boundary setting appeared to be a controversial issue as well because the Flemish had an urgent issue at stake: they wanted the deepening to take place preferably ‘yesterday’, while the Dutch highly valued the ecological system of the Scheldt Estuary. Therefore, the Dutch were also interested in taking into account its long-term effects. The interesting question playing here, then, was how to construct a long-term vision while an urgent issue is at stake. The spatial level of aggregation in the LTV was initially rather high in order to construct a long-term vision, but appeared to vary during the entire project. Interesting to observe were the motives for going into more detail. It was noted that regional actors were kept outside of the process due to the high level of aggregation. At the end of the study, a lot of regional actors were not happy with the results of the study.

In the LTV, the scale-related challenges played an important role. Dealing with the multi-stakeholder views on scale was difficult because of the conflicting interests. Scale became a political issue because the focus of the problem was considered crucial. An extension of the spatial and temporal boundaries would lead to the inclusion of more issues than the deepening. The researchers initially worked on their own preferred spatial scale; therefore, the dealing with the multi-disciplinary views on scale played a minor role at the start. At the end however, the policy analysts had to integrate all the information and had to handle a lot of scale discrepancies between models/ answers and policy questions. The boundary conditions (especially time) were crucial in the project so the scale choices were made in such a way that they contributed to the efficiency of the policy analysis.

Water Shortage Study (WSS) of the Netherlands
In the WSS, the problem of water shortage was analysed and options were studied to prevent and also to handle water shortage situations. The selection of the spatial and temporal boundaries in the WSS was made by the Dutch State Secretary of the Ministry of Transport and Water Management. The spatial boundary setting turned out to be quite delicate and was discussed many times during the study because the problems manifest themselves mainly on the regional scale and many interactions between the regional, national and river basin scales exist. Another difficulty was that water shortage was, at the time the WSS started, not really considered a problem. Water flooding received much more attention because it was seen as more urgent. Water shortage was considered to be mainly a long-term problem that could become a larger problem due to climate change. The interesting question in this matter was how to place a long-term problem on the short-term agenda, more or less the opposite problem of the Long-Term Vision. Another scale-related issue was that in the WSS the level of aggregation of the presentation scale was more than three times higher than that of the observation scale. How this difference arose and how it was handled was also studied.

Although the spatial boundary setting in the WSS was quite delicate, because the problems manifested themselves mainly on a regional scale while the national scale was selected, the scale-related challenges played a minor role because the problem was not considered urgent and no high conflicting stakes were at play. The consequences were also not considered severe, which caused a lot of actors to be somewhat indifferent. The selection of the national boundaries did not help either to get the regional actors involved. The project team wanted them to become involved and therefore secured their interest in the study by the selection of a low level of aggregation. This made the study interesting for them because models were constructed that they found very useful. The boundary conditions (like budget and time) did not play a key role: also because of the extensive modelling studies on a low level of aggregation, the project was delayed several times and the budget had to be extended.

4. Findings

The first conclusion of this research is that scale choices are very consequential: the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation do have important effects on the content, process and outcome of the policy analysis. Effects were present related to all rationalities, confirming that these rationalities play an important role in the making of scale choices. The findings show that scale selection is an important framing instrument that can be used by both the policy analysts and the other actors involved. The temporal and spatial scales and the level of aggregation influence the number and types of issues that are studied, the number and types of solutions that are involved and the number and types of effects that are evaluated. The level of aggregation also influences the depth of the issues, the solutions and effects that are being studied.

Also, scale choices influence the process: for example the number and types of actors that are involved, the possibilities for consensus building and the political sensitivity. The involvement of actors is influenced by the spatial boundaries and the level of aggregation. The spatial scale of the project also determines whether actors are dedicated to the process or not and whether they are critical, i.e. whether they are needed in the process. Although the level of aggregation is often handled in a flexible way, the starting point for the level of aggregation is crucial because it determines whether regional and local actors get involved or not. In the temporal boundary setting no effect was observed on the involvement of actors, nor on the dedication and criticalness of the actors involved. Depending on the temporal setting, it can, however, be noted that different types of people from an organisation become involved: if a shorter term is selected, more practical people are involved while on a long term more strategic people become involved.

Although the spatial boundary setting, the temporal boundary setting and the level of aggregation were analysed separately it appeared to be valuable to analyse them in one study because the cases show that scale choices have a close relationship to each other. The negative impacts of one scale choice may be compensated by another scale choice. The separate analysis made it possible to compare the types of effects that were present and the criteria that were mentioned by the different actors for each of the scale choices. The spatial boundary setting, the temporal boundary setting and the selection of level of aggregation appear to have some common effects, such as their effects on the scientific validity and the possibilities for consensus building. Also, the spatial boundary setting, the temporal boundary setting and the selection of level of aggregation appear to have some unique effects, which means that these effects were only observed in the analysis of that specific scale choice. Unique effects of the spatial boundary setting that were observed were, for example, the focus on the agenda and the coherence of issues. Unique effects of the temporal boundary setting that were observed were the robustness and efficiency of options and the sense of urgency that was perceived by the actors involved. Unique effects of the selection of the level of aggregation that were observed were the policy relevance for local issues, and the commitment and support of regional actors.

5. Framing guidelines and recommendations

The research findings led to guidelines and recommendations for policy analysts in the making of scale choices. The guidelines that are designed here are called framing guidelines because they intend to support the framing of the content and the process of the policy analysis. Also, they have a specific focus on the policy analysis process in which multiple stakeholders and multi-disciplinary researchers play a role.

Besides the framing guidelines, recommendations are given that support policy analysts in the design of the process of making of scale choices. First, it is important to explore the making of the scale choices and the demands that are put on the scale choice by determining the goal(s) of the study and the boundary conditions. This has two reasons: first, it is important to know to what goal the scale choices have to contribute and, second, it is important to know what limitations on scale choices are set up by the time and budget constraints. A controversy scan can be helpful to estimate the scale-controversy potential. A scale choice is potentially controversial when conflicting preferences exist and actors attach great value to the consequences of a scale choice (for example threatening to their own position). If the scale controversy potential appears to be high, then the next steps have to be executed thoroughly.

It is important to create a broad range of options for scale choices to prevent premature closure. To increase the breadth of the scale options, it is considered important to consult the actors involved in the design of those options.

Great care has to be taken in the evaluation of scale options. To be able to make a balanced decision the expected effects of the scale choices need to be estimated from multiple actor views, and expected dilemmas need to be identified. Make the options for scale choices and the impact of options and dilemmas transparent and discuss them with the actors involved in the policy analysis process. Also, it is important to be aware of the strategic handling of scale choices by the actors involved.

In the actual making of scale choices, it is important to make these choices fit with the objectives of the study and the boundary conditions. Also a multiple scale quick scan has to be done at the start to gain insight into the cross-scale interactions and if needed a multi-scale approach can be troughout the study as well.

Further, it is important to determine the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation in policy analysis in coherence because scale choices have a close relationship to each other. The negative impacts of one choice may be compensated by another choice.

Finally, after having made the scale choices, it is important to make them explicit during the process and in the project documents to prevent a Babel-like confusion of tongues when everyone is talking about different scales. Also, it is important to justify what the reasons were to make scale choices in such a way.

6. Contribution of this research

This thesis makes a number of contributions to the field of policy analysis.
First, it shows the importance of scale choices to the field of policy analysis. Policy analysis results are sensitive to scale, therefore scale choices are a relevant and non-trivial issue. The making and handling of scale choices involve many dilemmas and, if not conscientiously addressed, many pitfalls play a role.

Second, the thesis shows specific effects of scale choices on the content and on the process of the policy analysis. The construction of system diagrams gives insight into the variables that are taken into account, the exogeneous factors and the options. The construction of actor analysis diagrams shows what actors are included or excluded and whether they feel dedicated or are considered critical. These specific effects are where possible translated to framing guidelines that support policy analysis design and help to think the consequences of scale choices through.

Third, the tool presented in this thesis to make scale choices a subject of discussion can also serve as a means for the policy analyst to address other fundamental issues that are usually present below the surface but are hardly ever out in the open such as differences in power, interests and hidden agendas. When discussing options for scale choices, a seemingly harmless and substantive subject, actors involved may be tempted to reveal a little more of their way of thinking and strategy.

Finally, the thesis also shows that using the policy analysis approach for policy analysis itself (i.e. performing a miniature policy analysis at the start of the policy analysis process) is very helpful. After all, when the stakes are high, it would seem only rational for those trained as analysts to perform an 'impact assessment of design' in the early stage of any policy analysis process. Therefore, this research also contributes to the quality of policy analysis design.

1. Problem formulation and research approach

There is a difference between knowing the path and walking the path.

-Morpheus in 'The Matrix'

1.1. What are scale choices?

Scale is an essential element in many discussions in day-to-day life, even though we are usually not aware of it. For example, in the Netherlands, the requirement of fine dust filters for diesel oil cars is under discussion. Diesel oil cars are thought to have a more severe negative impact on the environment than gasoline cars. Whether this is true or not depends, to a large extent, on the scale that is used to evaluate the impacts. According to dust levels near roads (on a small scale), diesel oil cars are considered to be one of the major causes of the fine dust problem in the Netherlands. At the moment the negative impacts on the local scale seem to prevail in the policy debates, because the fine dust is an important issue on the national political agenda. However, for middle class diesel oil cars, the carbon dioxide production is often more than 10% lower than the carbon dioxide production of comparable gasoline cars. So, looking at it on a global scale, it would be better if more people drove diesel oil cars to reduce the problem of global climate change. Also, on a temporal scale this difference can be noted; the problems caused by fine dust play on the short term while the reduction of carbon dioxide contributes to a decrease in the climate change problem in the long term. This introduces an interesting but difficult, and often neglected, question: What is better for the environment, diesel oil cars or gasoline cars? And a closely related question: On what scales are the effects of diesel oil cars evaluated?

In the design of every study, boundaries in space and time have to be set. Also, it has to be determined what level of detail is to be used for the study. These choices are called scale choices. Box 1.1 gives an example of a spatial boundary setting, Box 1.2 gives an example of a temporal boundary setting, while Box 1.3 gives an example of the selection of the level of aggregation.

Box 1.1: Spatial boundary setting: Defining the extent of the coastal zone

In the EU Recommendation concerning the Implementation of Integrated Coastal Zone Management in Europe (2005), the EU government has deliberately defined no boundaries regarding the coastal zone. It was concluded that it is not meaningful to define clear boundaries because there are so many different options for them. It all depends on the perspective and the function that is considered important (Ministry of Transport and Water Management, 2005). The Netherlands often uses the definition employed in the National Spatial Strategy (2005):

> …the coastal sea, beach, dunes/sea dikes and the strip landward of them which bears some functional or cultural relationship to the coast…On the seaward side, the 20-metre bathymetric line is regarded as the limit; on the landward side, limits can vary, depending on the function under consideration. From the nature conservancy point of view, the limit will often coincide with that of the dune area; where public safety is concerned, it will coincide with the flood defence zone. In the case of a function like tourism, however, the coastal zone may well be regarded as stretching far inland.
> (EU Recommendation concerning the Implementation of Integrated Coastal Zone Management in Europe (2005), p. 4)

In the process of making a coastal vision led by policy makers of the Ministry of Transport and Water Management in the Netherlands in 2007, the issue of spatial boundary setting of the coastal zone was addressed during a workshop in which three different perspectives were addressed: people, planet and profit (see Figure 1.1 for the resulting maps with the boundaries of the coast). During the boundary setting of the coastal zone when using these different perspectives, different arguments played a role that led to different spatial boundaries. The people perspective resulted in the smallest spatial boundaries and mainly included the coastal municipalities. The institutional boundaries played an important role here. The planet perspective resulted in the largest spatial boundaries: from the -30 metres NAP line to the 0 NAP line (to the city of Amersfoort). This coincides with the morphological boundaries (area below sea level). The profit perspective resulted in the largest variation in geographical boundaries because so many different economic functions play a role in the coastal area.

It finally was decided to work with a core area and a peripheral area. Also, it was concluded that the relevance of setting boundaries along the coastal zone is limited because the coastal area is not that different from the hinterland.

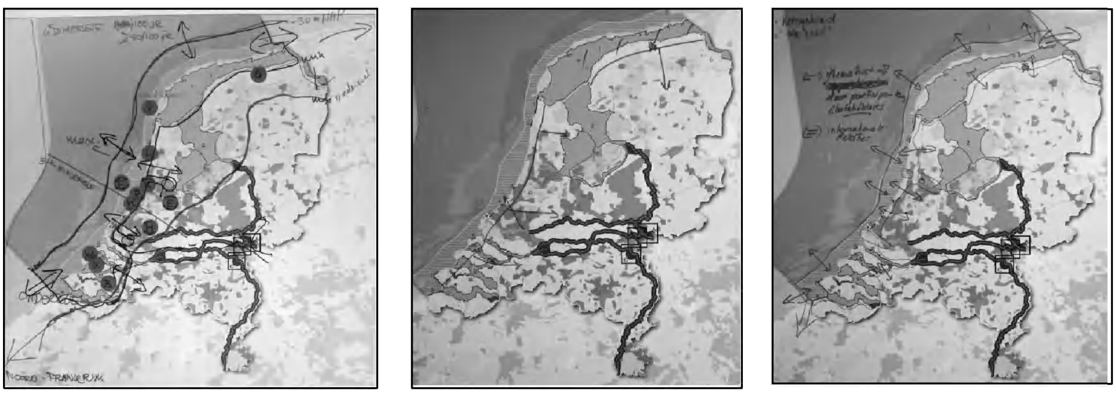


Figure 1.1: Three perspectives on the Dutch coast: a. Planet, b. People, c. Profit

Box 1.2: Setting time horizons for strategy building in a telecommunication company
For a telecommunication company, five years is often regarded as a long period for the division that is involved in mobile communication, because of rapid changes in technology (highly dynamic situation), for example from GSM, Edge, UMTS, HSDPA to Wifi. For those involved in investments in communication through fixed networks, however, five years is considered a short period because the technology and the market are much more stable. In fixed networks, 15 to 20 years is a commonly used time term for investments. Duijn and Stavleu (2006) use this example to show that, even within one company, time horizons that are used can be very different depending on the dynamics of the system.

Box 1.3: Selection of level of aggregation in climate change modelling
Calculations by the IPCC indicated that fewer storms over the Mediterranean Sea would result in a decrease in precipitation in the Middle Eastern region by 15-20%. This would have large negative impacts on the economic stability of the region. The Arabian Desert would become drier and the desert's size would increase (IPCC, 2005). However, the IPCC models were constructed on a very high level of aggregation. Evans (2008) constructed a more detailed climate model for the Middle Eastern region. This model showed the opposite results: the number of storms on the Mediterranean Sea was indeed expected to decrease, but this meant that humid air from the west would reach further into the region. In the Zagros Mountains, cloud formations would be formed which would result in about 50% more precipitation. This implies that the Euphrates, Tigris, Assi and Jordan rivers would not dry up but would increase in size. This example shows that the inclusion of local details can lead to entirely different conclusions.

These three examples show the complexity that is related to the making of scale choices, the multiple views that exist, and the lack of uniformity. Spatial boundaries, time horizons and levels of aggregation appear to be relative notions. Scale is therefore increasingly recognised as an important research object (Gibson, 1998; João, 2002; Rotmans and Rothman, 2003). The making of scale choices is a very important matter, because scale is essential in the search for and the explanation of observed patterns (Rotmans and Rothman, 2003). Patterns may appear on one level and may be lost on another (Gibson et al., 1998), as the case in Box 1.3 illustrates. The spatial and temporal scales and level of aggregation at which studies are undertaken can strongly affect the conclusion, as processes and parameters important at one scale/ level of aggregation may not be important or predictive at another scale/ level of aggregation (João, 2002).

Haufler (1999) states that in many published studies there is no acknowledgement of the sensitivity of the results to the scales at which the studies were conducted. Addressing a question with the 'wrong scale' often leads to a failed explanation and to 'wrong conclusions' (Wiens, 1989; Turner, 1990). Also, this lack of recognition of the sensitivity of the results to the scales may be used to strategically influence outcomes of a study. Box 1.4 shows an excellent example of the political consequences related to the setting of spatial boundaries and the possibilities of manipulating the outcomes by strategically handling scale choices.

Box 1.4: Assessing the impacts of a road construction project
The selection of spatial boundaries in assessing the impact of a road construction project is critical to the outcome of the impact assessment. When the assessment is performed for an area limited to 100 metres along the road, the environmental impacts are much larger than when the impact is assessed over an area of 1 kilometre along the road, because the effects are averaged out. For an actor in favour of the road construction, it is strategically advantageous to make sure that a larger area is selected for the impact assessment because this makes the negative effects less obvious (João, 2002).

The example in Box 1.4 also shows the close relationship of spatial scale to the level of aggregation. Effects often fade out on a larger spatial scale because a higher level of aggregation is often used.

Another problem is that sometimes policy measures can cause a shift in the problems to a larger scale. This can be unintentional because insufficient knowledge about the effects is present (as seen in Box 1.5). Also, it is possible that people are aware of the effects of the shift in problems but they are strategically neglected or are accused of strategically neglect (see the example in Box 1.6).

Box 1.5: Unintentional shift in the problem to another scale by constructing smokestacks to prevent acid rain
In Europe, the acid rain problem played a very important role in the 1980s. Instead of focusing on the causes of local air pollution, higher smokestacks were built to solve the problem. If this had happened in only a few places in the industrial world, it might have been no problem. But numerous local smokestacks were built, causing an accumulation of sulphur compounds in the higher strata that resulted in widespread regional acidification problems. The solution to a local problem created a new regional problem (Folke et al., 1998). It is doubtful, in this case, whether the shift in the problem could have been prevented based on the knowledge available. Nevertheless, it shows that the selection of scale choices should be done very carefully as effects of solutions may not be restricted to the scale at which the solution is implemented.

Box 1.6: Scale of the study ignores shift in problems to a larger scale
In the province of Zeeland, in the south-western part of the Netherlands, the water quality of the some lakes is a big problem as a consequence of closing the area of the sea by the Delta Works. The nutrients from upstream agricultural areas flowing into the lakes cause large problems with blue algae. To improve the water quality ideas have been worked out the salinify the Volkerak Zoom lake.

One of the issues involved is that this will lead to less fresh water in the area. By doing so, also the salt tongue will move to the north of Zeeland and also affect the water inlet points up north and the water quality in the system in the province of Zuid-Holland.

When a study was started on the fresh water supply for the agriculture, at first, the scale was selected in such a way that only effects of salinification of the Volkerak Zoom lake in Zeeland were studied. Reason for this was that the adjacent water board of Hollandsche Delta did not want to get involved and did not want to start a discussion on the water supply in their area.

This limited boundary setting annoyed the water board of Delfland that would also be affected by the brackish water and made them accuse the province of Zeeland to make the scale choices on purpose in such a way that the negative effects outside the province of Zeeland were ignored using the excuse of matching with the boundaries of their jurisdictional area.

Finally, a broader study was started in which the other water boards were involved as well to study the possibilities to reduce the leaking of the salt to the other regions.

Making scale choices can sometimes raise a lot of discussion points between the actors involved. The example given in Box 1.7 illustrates the important role of the selected perspective.

Box 1.7: Different perspectives in valuation of effects of cutting Philippine mangrove woods

Effects are valued differently by actors at different scales. This is exemplified by the proposal of a large company to cut the mangrove woods in the Philippines in order to create large fish ponds. This would be good for regional employment and the national economy, so the regional and national governments were very much in favour of this idea. The local inhabitants were severely against it because they would be forced to work at these large companies instead of making a living from their own small-scale fishing activities. Also, the international community argued fiercely against this proposal. The mangrove woods are a very unique ecosystem that should be preserved as much as possible (Resource Analysis, 1998).

The examples in this section all illustrate the political consequences of scale choices and the possibilities of strategically influencing the outcomes by choosing scale choices strategically. They thus emphasise the importance of making scale choices deliberately and carefully.

1.2. Scales and scale choices in policy analysis in water management

The previous section provided examples of the importance of scale choices in space, time and leven of aggregation in very diverse fields. This section focuses on the role and importance of scale and scale choices in the area of this research: policy analysis in water management.

Processes in water management operate at different scales, both in space and in time. Water systems influence, and are influenced by, people at a variety of social scales. Integrated water management necessitates consideration of both the human and the physical systems and a great number of scientific disciplines such as hydrology, geography, morphology, ecology, economics, policy sciences and sociology.

In water management a variety of spatial and temporal scales can be distinguished; water systems have large variations in extent. A distinction can be made between systems on a global, river basin, regional and local scale:

- Global scale: At the global, worldwide scale the changes in the fluxes of precipitation and evaporation, and changes under the influence of global warming play a role.

- River basin scale: At the river basin scale, the impact of upstream measures on downstream areas can be considered. A river basin can be defined as an ecosystem from the source to the mouth of the river including all its branches and groundwater.
- Regional scale (groundwater, rivers): At the regional scale important processes are the inflow of groundwater and surface water from different areas, transport of contaminants through the soil, and the influences of hydrological measures such as the construction of reclamation areas to the regional groundwater regime.
- Local scale (channel, city): At the local scale, for example, the water balance of a municipal area plays a role. Inputs of this system are precipitation and the drinking water that is transported into the area. The output consists of rain water and polluted wastewater which go to a wastewater treatment plant. Other examples of local systems are a small lake or a polder, i.e. water systems that are quite isolated in regard to the regional water systems.

Natural processes in water management also play roles at very different time scales. They may range from highly dynamic, such as the river discharge to the sea that takes a few days (small temporal scale), to very slow, such as the diffusion and dispersion of contaminants in the groundwater that may take many years (large temporal scale).

Important scale choices are decisions about what spatial and temporal scales the water management issues are to be handled. The questions that need to be addressed include, for example, which management issues should be handled at what hydrological scales (river basin, river branch, channel, etc) and at what institutional, administrative scales (national, regional or municipal).

Water management policy processes can be supported by policy analysts to increase the quality of decisions. Policy analysts generally have two aims: to support the policy making process by gathering, integrating and structuring information, and to facilitate a multi-stakeholder communicative debate (Twaalfhoven, 1999). In this research, policy analysts are regarded as a kind of broker between the policy makers who have questions and have to make decisions and the researchers who can provide information and answers. Figure 1.2 shows a diagram of this view; the arrows pointing to the left indicate communication about the questions asked, and the arrows pointing to the right indicate communication about the answers provided.

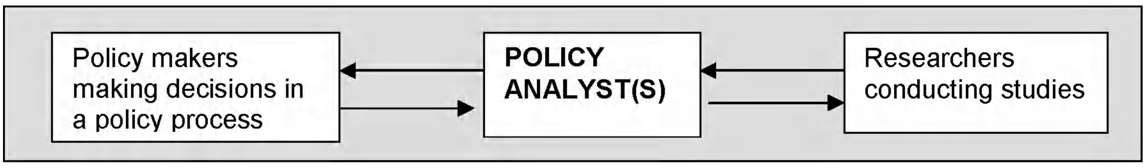


Figure 1.2: A simplified view of the role of a policy analyst

In the design of every policy analysis process, boundaries in space and time have to be set. Also, the level of detail that is to be taken into account has to be determined. Examples of important scale-related questions are: At what scale are the problems going to be defined and studied? At what scale are policy options to be designed? At what scale are the effects assessed and the results presented?

Often, the scale is seen as a derivative of the problem addressed: first, the problem to be studied is selected and the scale then follows logically from this choice. However, this is only possible if a single problem is studied (or several problems that occur on the same scale). More often, when a study comprises several problems, these problems will play at different scales.

As can be understood from the previous section, different points of view can be chosen in the selection of scale. Different actors may have different ideas about the appropriateness of the scale choices depending on their interest in the study and may provide sound arguments from their point of view. As illustrated in the previous section, scale is not politically neutral; scale choices have a strategic value because the selection of scale may (intentionally or unintentionally) privilege certain stakeholders at the expense of others (Lebel, 2004). In policy analysis processes, many actors with different (or even conflicting) interests at different scales may be involved. Some of them will be privileged if the problem they perceive as important is central at the selected scale. The example of the road construction in Box 1.4 illustrates this, as it shows that the choice of a large spatial scale combined with a high level of aggregation may hide the local negative effects and therefore lead to a conclusion that is convenient for an actor in favour of the road construction.

Often, no ideal scale exists because all options for scale choices have advantages and disadvantages, not only for the actors involved with specific interests but also on a more general, project level. "The fact that there is no single correct scale at which to describe a system does not mean that all scales serve equally well" (Levin, 1992, p. 1960). Although the scale choices are subjective, the location of the boundaries should not be arbitrary because there are better and worse places to locate the boundaries (Scholes and Lebel, 2002). What is fundamental to recognize is that we need "to understand the consequences of suppressing or incorporating detail" (Levin, 1992, p. 1947). Likewise, it is of vital importance to understand the consequences of changing spatial and temporal boundaries.

Scale choices involve the making of difficult trade-offs in which dilemmas play an important role. For example, choosing broad boundaries will make the analysis complex from the onset, but initial problem formulations that are too narrowly focused and oriented to one specific solution type may lead to ignoring more fundamental but far superior solutions (Thissen, 2000). This makes the making of scale choices even more complicated.

1.3. A quick scan to explore the problem

1.3.1. Introduction

The previous sections led up to the conclusion that scale choices have large consequences and are not politically neutral and that no ideal scale exists because trade-offs between different interests have to be made. This complicates the making of scale choices. Because of this complexity and importance, one would expect a lot of attention in the literature about how to make these choices. The question that also comes up is how these difficulties are handled, in other words, how are scale choices made nowadays?

To find an answer to this question, a quick scan was performed that consisted of two steps:

1. Exploring the theory by doing a quick scan of the policy analysis literature on making scale choices.
2. Exploring the practice by conducting a survey amongst 80 water professionals (researchers, policy makers, etc) and five in-depth interviews of experienced policy

analysts. The goal of this quick scan was to find out how actors involved in water management make and handle scale choices in practice and whether they regard it as a difficult issue.

This quick scan is actually part of the literature study but the results are shown in this chapter because it was used to illustrate the relevance of this research and to determine the relevant questions that are not addressed in literature yet.

1.3.2. Exploring the theory

The importance and difficulty of scale choices in policy analysis is stressed by several authors in the literature on policy analysis. Morehouse (2003) states that identifying the appropriate temporal and spatial scales for research and dissemination is always challenging. She calls the selection of appropriate scale essential. Consideration of temporal scale is important, for shorter term trends in human and physical systems may hide important longer-term patterns, while similarly, long-term trends may mask important short-term variations that may have profound impacts on human or physical systems (ibid.).

A very important concept that is closely related to scale is the boundary: what is included and what is not? Boundaries are essential because they specify the area over which jurisdictions apply, as well as the roles that particular parties, also called actors, are assigned (Murphree, 2000). “The determination of boundaries is largely a matter of judgement supported by very rough analysis. The point is that we should at least think about the entire problem and deliberately decide what aspects we are going to tackle or include and what to leave out” (Quade, 1975, p. 48). Morgan and Henrion (1990) address the importance of setting boundaries and calls the careful examination of where to set the boundaries an important part of the policy analysis. This also involves looking at the implications of alternative choices of boundaries. Morgan and Henrion (ibid., p. 31) also stress that it is important to “make explicit and communicate how boundaries that have been selected may limit or otherwise affect the nature of insights and understanding the analysis may yield”. They call the choice of what to include and what to leave out one of the most fundamental and difficult problems in policy analysis (ibid.). Most of the time systems and problems are interconnected with the broader world in what appears to be a seamless web of associations and dependencies. They ask a question to which they admit they cannot offer a simple recipe: “What should you model and what should you treat as exogenous, that is, external to the problem?” (ibid., p. 31). Quade (1975) argues that: “Good policy analysis should seek to establish the boundaries of the issue under investigation where thought and analysis show them to be and not where off the cuff decisions or convention, whether established by government jurisdiction, academic tradition, or industrial practice, would have them be.” (p. 51-52)

Miser and Quade (1988) call the choice of a time horizon over which to consider the balance of costs-benefits often very hard for the analyst to defend. Checkland (1985) mentions the importance of determining boundaries and constraints in formulating a problem as well as the possibility of adjusting boundaries in the early phase. Also, he mentions the difficulty of boundary setting: “Can any boundary be drawn? How can the analyst justify the limits that practicality forces him to impose?” (Checkland, 1981, as cited by Wu, 1984, p 182). Majone and Quade (1980) observe that it often seems ‘natural’ for an agency or institution working on a specific problem to consider only alternatives falling within its jurisdiction. “This leads to sub-optimisation and maybe to the impossibility of finding a solution, and the related pitfall is to assume that the scope of analysis should coincide with the scope of decision-making authority" (p. 10).

In sum, the literature confirms the importance of and difficulty in the making of scale choices. Therefore, one should be expected to find some help and guidelines on scale choices, boundary setting or related terms in the handbooks on policy analysis. However, neither the popular *Basic Methods of Policy Analysis and Planning* by Patton and Sawicki (1993) nor the *Crafts Issue of the Handbook of Systems Analysis* of Miser and Quade (1988) nor Dunn's Introduction to *Public Policy Analysis* (1981), often referred to as important handbooks of policy analysis, mention anything on boundary setting or scale choices. Much attention is devoted to problem framing and the system definition. Scale choices form an essential part of the system definition. The system definition comprises however more; it also includes what variables to take into account. Sometimes when there is an overlap because variables are spatially related, scale choices are indirectly automatically taken into account. But it is also possible that the variables to take into account and the scale choices are two separate decisions. Nevertheless, scale choices do not get any attention. Also the design of options, modelling, and the evaluation of options by using multi-criteria analyses and cost-benefit analyses gets a lot of attention. Although scale choices are closely related to many of these subjects, they remain untouched.

The conclusion that can be drawn from this literature scan is that although the importance and difficulty of making scale choices is stressed by quite a large number of authors, there is little theory and guidance available on how to make and handle these choices in policy analysis. This lack of attention is also mentioned by some authors in fields related to policy analysis. Rotmans and Rothman (2003) state related to integrated assessment that the choices made regarding geographic and time scale of the issues considered and the inherent limitations involved require more attention than given so far. João (2002) regards the making of scale choices as the Cinderella topic of Environmental Impact Assessment.

1.3.3. Exploring the practice

People working in the field of water management and policy analysis have been approached to find out whether they regard the making of scale choices a difficult issue, what the involved difficulties are and how the making of scale choices works out in practice.

Survey
A survey was developed and distributed among a large, diverse group of actors whose daily work involves policy making, policy analysis and research on water management. The goal of this survey was to gain insight in the views of water professionals on scale issues and how scale choices affect their work. First, the relation with the disciplinary background of the respondents was asked and the characteristic spatial and temporal scales in their discipline. Second, the definition of scale issues was discussed. Next, the role of scale choices in their work was discussed and an example was asked. Finally, the criteria that are used in the making of scale choices are discussed and the consequences scale choices have. The list of survey questions can be found in Appendix 1. This survey resulted in over eighty reactions by researchers from many different disciplines, by policy makers, water managers, policy analysts and stakeholders. The majority of respondents stated that they thought scale choices are a very important but also a difficult subject. Also, a number of reactions showed that

people consider scale choices get too little attention or even are often made in a wrong way.

The respondents were asked to list criteria that they use to make scale choices. Their answers confirmed the complexity of the problem, revealing a large number of diverse criteria as being important in making these choices. An attempt to categorize them resulted in the following categories:

- Resource-related criteria, such as time, budget and manpower
- Data-related criteria, such as availability of data and access to data
- Stakeholder-related criteria, such as relevance for stakeholders, willingness to cooperate, use of the results
- Problem-related criteria, such as the nature of the problem, natural patterns and degree of heterogeneity
- Study-related criteria, such as the objective of the study and manageability
- Outcome of the study-related criteria, such as policy relevance, target group and social acceptability, scope of the message

The survey also included a question concerning the consequences of choosing a particular scale. Although the criteria that were mentioned obviously have a close relationship to the possible consequences, this question was regarded as much more difficult than the question on the criteria. A number of respondents mentioned that they were interested in learning more about the consequences of scale selection because they thought that knowledge on effects of scale choices was lacking at the moment.
Below are examples of the consequences that were mentioned:

- The bigger the scale the higher the costs of study
- Bigger scale units are more difficult to manage
- The finer the scale the more data intensive the study and the greater the difficulty of calibration
- Scale could limit the number of options that are available to develop solutions
- Scale choices define what factors are considered internal and external and whether they can be balanced

Interviews
Interviews held with five senior policy analysts also confirmed that making scale choices is an important and difficult matter. All of the interviewees observed that numerous pitfalls do appear frequently. A pitfall is a conceptual error into which people frequently and easily fall but can be avoided (Majone and Quade, 1980). When asked to characterise these pitfalls, the general ones that were mentioned by several analysts as frequently being encountered and having important consequences were:

- No explicit selection of scale. This can lead to a Babel-like confusion of tongues because the actors involved are all talking at different levels of scale and aggregation.
- Arbitrary selection of scale or selection of the most apparent scale.
- Selection of scale not done in relation to the objective of study or the level of authority of the commissioner.
- Selection of level of aggregation not done in relation to the expected variability of the system.
- Selection of level of aggregation not done in relation to the selected spatial boundaries (often too much detail included in broad-scale studies).
- Mixing objectives and measures that require very different levels of aggregation.

- Selection of too narrow boundaries, resulting in a lack of insight into the context and causes of the problem.
- Subconscious alternating from one scale to another.

1.3.4. Conclusions

Scale choices in policy analysis processes are made all the time in practice, consciously or subconsciously. Although both researchers and practitioners consider scale choices to be important, consequential and difficult (Table 1.1), these choices nevertheless receive little attention in both the literature and in practice. And yet when asked directly, all practitioners mention numerous and diverse criteria that play a role in the process of making scale choices.

Table 1.1: Summary of quick scan results

Issue	Theory	Practice (survey)	Practice (interviews)
Importance stressed	Yes	Yes	Yes
Difficulty stressed	Yes	Yes	Yes
Reasons for difficulty	Many interdependencies	Many different criteria	Many pitfalls
Sufficient attention	No	No	No

The results of the quick scan make scale choices an even more intriguing subject and provide sufficient reason for a comprehensive study into this matter. What criteria play a role in the making of scale choices in what kinds of situations? What kinds of specific effects do scale choices have? How are scale choices strategically made and handled by actors?

1.4. Research questions and objective of study

The quick scan revealed that scale choices do matter, have important consequences and are considered difficult, but they nevertheless receive little attention in both the literature and in practice. This calls for a closer look into the effects that scale choices have and the way they are handled in practice. This leads to the first research question:

1. What role do scale choices play in policy analysis processes in water management?
The first aim of this research is to provide more insight into the role scale choices play in multi-actor policy analysis processes. As different actors are involved, different perspectives on scale choices must be revealed: different perspectives can result in different scale choices. Also, it is important to find out how actors involved in policy analysis processes view scale choices, and how these choices are made in the design of a policy analysis process, and to understand the effects of these scale choices on the results of the study. This results in the following descriptive questions:

a) What perspectives on scale choices exist in general?
b) What are the specific effects of scale choices?
c) What challenges play a role when making and handling scale choices?

A clear difference is made in this study between the *making* of scale choices and the *handling* of scale choices. The making of a scale choice is defined as the decision process that leads to the choice of scale, while the handling of scale choices refers to how the scale choice is dealt with in the policy analysis process after that choice has been made. Is it adjusted, neglected, strictly used or interpreted in a flexible way?

Assuming that insightful answers to the first research question can be found, the next research question is whether and how the making of scale choices can be guided.

2. How can the making and handling of scale choices be guided in such a way that they contribute to the success of a policy analysis process?
It is important that scale choices are made in such a way that they contribute to the success of the policy analysis process. However, success is a complicated issue. Twaalfhoven (1999) concluded that success can be perceived differently by different actors involved and that they use different criteria in different situations to judge the success of a certain policy analysis process. In this research, success will be addressed in close relation to the goal of the study, which will be explained in Chapter 2.

In the design of the policy analysis process, policy analysts have a large responsibility. Therefore, they have a clear interest that scale choices are made in such a way that they contribute to the success of the policy analysis process. Also, they may play a role in guiding the process of making these choices. Therefore, the policy analysts' perspectives play a key role in this research and in the next two research questions. Two design questions are involved:

> *a) How can scale choices be used as an instrument to contribute to the success of the policy analysis process?*
> *b) How can the process of making scale choices be designed in such a way that the scale choices made contribute to the success of the policy analysis process?*

This will contribute to a better design of policy analysis processes and, in the end, to the success of policy analysis overall. Potential beneficiaries of this research are the actors involved in the policy analysis process who consider transparency an important value because this thesis provides more clarity into the effects that scale choices have and the ways in which they are or can be used to strategically influence the outcomes.

1.5. Research approach and structure of the thesis

Overall approach
Because little is known about the making of scale choices in policy analysis in theory and practice, this research has an *exploratory* character. It combines a broad literature study on making scale choices, in general, and the concept of policy analysis with observations of making and handling scale choices in the practice of policy analysis processes. For this research, a case study approach has been used. According to Yin (1989), a case study is an inquiry that investigates phenomena in their real-life context, where boundaries between the phenomenon and its environment are not evident and where the analysis uses multiple sources of evidence. Neustadt and May (1986) also argue that studying historical cases can be reflective and helpful in getting insights into causal relationships.
Case study research is considered apt for exploratory and descriptive research to derive theories and to examine phenomena in their natural setting (Yin, 1994). This natural context causes the interrelationships to stay intact (Hutjes and van Buuren, 1992). Case study research

is therefore considered a useful research method for this research because it does justice to the complex process of making scale choices and has the ability to take the context into account. It is also considered the only way to gain insights that are relevant for this exploratory research. The dilemma that always plays a role in case studies is structuring versus contextual sensitivity (Francke and Richardson, 1994). The different research approaches to handle this dilemma all have advantages on some points and disadvantages on others. Therefore, a case research strategy has been selected for this research that aims for a structured approach by developing a conceptual model, at the same time doing justice to the contextual sensitivity by using semi-structured interviews and observations.

The overall research approach consists of three parts:

1. Theory, conceptual model and case study research approach
2. Empirical case studies
3. Synthesis and discussion

In the discussions during the quick scan, it appeared that scale choices are often regarded as a vague and intangible issue. This leaves the researcher with the challenge of making it more tangible. This is done in three different ways:

- Giving numerous practical examples of scales, making and handling scale choices
- Making scale choices more explicit by showing and discussing the available options for these choices
- Showing specific perspectives on scale choices

Part I: Theory, conceptual model and case study approach

As shown in the previous sections, scale choices are a complex phenomenon. Complex phenomena are best analysed by developing multiple perspectives (De Bruijn, 2004). The more complex a situation, the larger is the number of plausible perspectives on it, because the harder it is to prove anyone of them wrong in any simple terms (Dryzek, 1997). None of the perspectives can create a complete picture of the phenomenon but all perspectives together can provide a reasonable approximation (De Bruijn, 2004). Therefore, an approach is used that enforces a look at the problem from multiple, rational perspectives. First, a general introduction to policy analysis and different rationalities in policy analysis is given. Next, using these rationalities as a structure, the theory about scale choices is discussed in order to explain their different rational perspectives. Finally, a conceptual model is constructed based on the theory that provides a framework for the description of the process of making and handling scale choices.

Part II: Empirical case studies

The conceptual framework developed in Part I is used in two case studies. Two in-depth case studies are used because the contextual setting is thought to be of vital importance to the process of making scale choices. The main objective of the case studies is to gain more insight into the actors' perspectives, the dilemmas that play a role in making and handling scale choices and their effects. Studying multiple scale choices in a case (spatial boundary setting, temporal boundary setting and selection of level of aggregation) makes it possible to focus on the interactions between the scale choices made.

This research focuses on policy analysis processes concerning water management. The reason for this is twofold. One reason to focus on water management is that integrated water management is pre-eminently an interdisciplinary field of research in which many spatial and temporal scales are involved that are closely interrelated. The other reason is more practical.

This research is funded by institutes and programmes that have a close relationship with water management: the Delft Interfacultary Research Centre Water, GeoDelft/Deltares and Delft Cluster. In the research centre, scale issues is one of the research programmes. In this programme, researchers from several faculties from the Delft University of Technology including Civil Engineering, Applied Earth Sciences, Biotechnology and Systems Engineering and Policy Analysis conduct research on scale issues related to water. Deltares is a large knowledge institute working on the management of water, soil and subsurface. Delft Cluster is a network organisation of Dutch institutes specialising in water management and building in deltaic areas.

Part III: Synthesis and discussion

In this part, the findings from theory and practice are synthesised. A framework for design reflection is made that supports the process of making scale choices. This framework explicates controversy, gives insight into perspectives, dilemmas and the effects of scale choices. Also, it shows a methodology about how to make and handle scale choices. Because of the dilemmas, it is not possible to formulate general, clear and simple guidelines on which scale choices should be made and how they should be made. Rather, the framework for design reflection should facilitate rational deliberation in the process of making scale choices.

Structure of the thesis

Figure 1.3 shows the outline of this thesis. Chapter 2 focuses on policy analysis in general and on the design of policy analysis processes. Chapter 3 provides some background on scale (choices), the definitions, and explains the rational perspectives on scale choices. In Chapter 4 a conceptual model is presented that provides a framework for the description of the process of making scale choices. Also, the selection of the cases and an in-depth description of the methodology followed in the case studies (data collection and analysis) are explained. Chapters 5 and 6 provide an introduction to the respective case studies, the Long-Term Vision of the Scheldt Estuary and the Water Shortage Study of the Netherlands. In Chapters 7, 8 and 9 the scale choices made are analysed for both case studies. Chapter 7 addresses the spatial boundary setting, Chapter 8 the temporal boundary setting and Chapter 9 the selection of the level of aggregation. Each of these chapters concludes with a comparison of the two cases in which the differences and similarities are explained. Finally, in Chapter 10 the lessons learned are synthesised and translated into design guidelines and recommendations. Also, a reflection on the research approach is given.

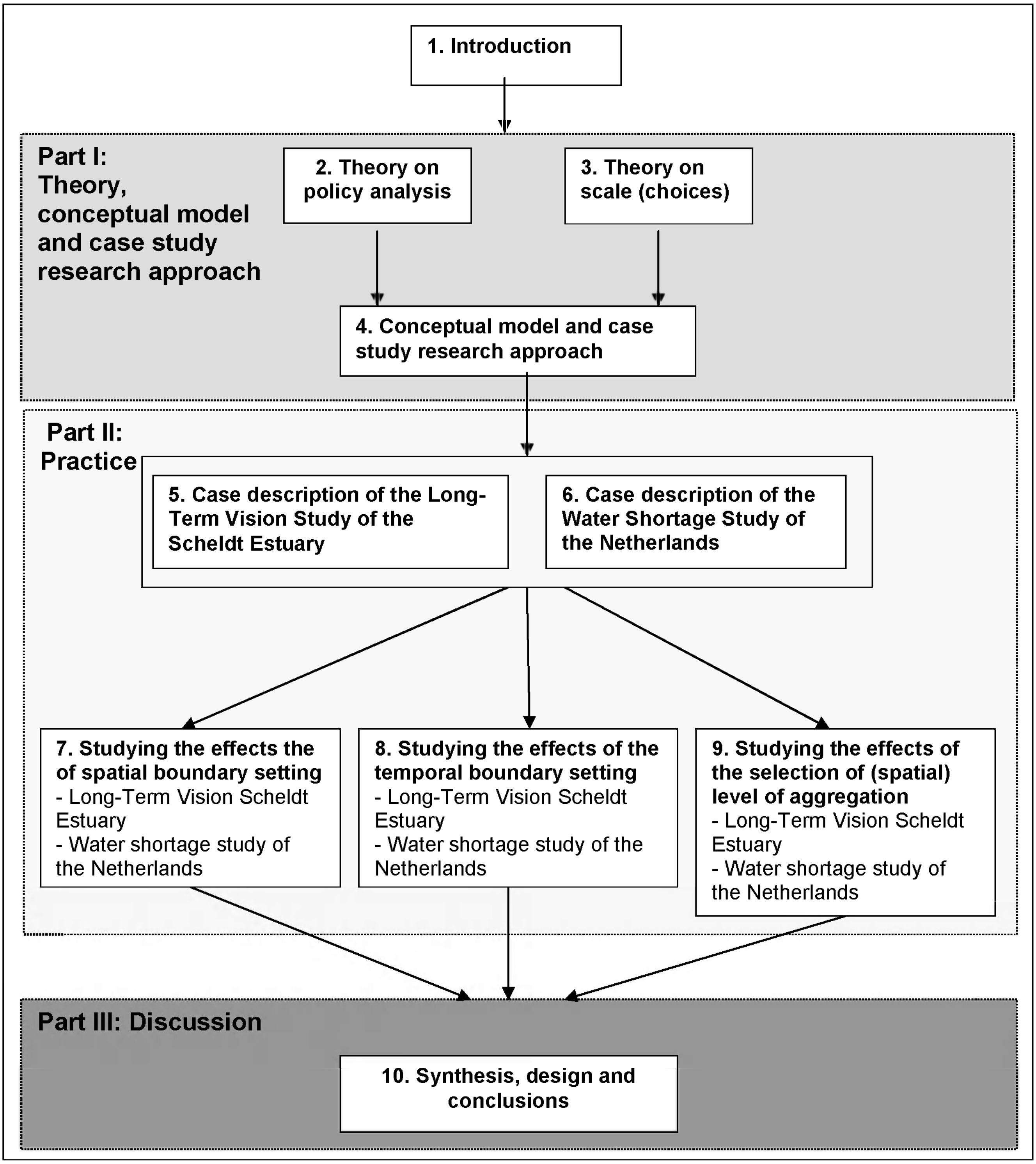


Figure 1.3: Graphic outline of the thesis

2. Policy analysis: the edge of reason

Knowledge is only perception.

-Socrates

2.1. Preview of the chapter

Considering the objective of this research, understanding how scale choices are made in policy analysis and their effects, it is important to define more precisely what policy analysis is. In this chapter the theory of policy analysis is therefore explored in greater depth. First, a definition of policy analysis is provided and, then, some background on it and its role in policy processes is given. Defining policy analysis, however, is more difficult than it may sound at first.

Because of difficulties with the definition, different perspectives on policy analysis are presented that relate to different rationalities. These rationalities emphasise different aspects that all comprise policy analysis. The presence of these different rationalities also has consequences for the way scale choices are looked upon in policy analysis. Therefore, in this research, four different rationalities are identified that play an important role in policy analysis and that differ in their perspectives on policy analysis and in the way scale choices are regarded. These four rationalities will be used in the remainder of this research to help structure the views on scale choices and their effects.

2.2. Defining policy analysis

Policy analysis is not a profession that the general public understands (Radin, 2000, p.1). “It is difficult to find the right words to describe the field of practice. One could choose terms as advice giver, personal counselor, creator of options, information broker, researcher or evaluator, but none of them quite captures the breadth and the depth of the role of policy analysts and the field” A great deal of research and consultancy has been carried out to support government policy, but often it is not regarded and defined as policy analysis (Mayer et al., 2004). According to Wildawsky (1979), as a discipline, policy analysis does not fit neatly into the disciplinary map. All of the above reasons contribute to the difficulty of providing a clear definition but also of giving policy analysis its own identity.

Policy analysis aims to facilitate the policy-making process by producing policy-relevant information that can be utilised to resolve problems in specific political settings (Dunn, 1981).

The hallmark of traditional policy analysis is its focus on rational methods to support decision making. Problems are cast as a choice between alternative means for achieving a goal (Stone, 1988). Different approaches to policy analysis share common characteristics: they proceed on the assumption that one can analytically study policies, their causes and their consequences (Heineman et al., 1990). According to Dunn (1981) policy analysis is "an applied social science discipline which uses multiple methods of inquiry to produce and transfer policy-relevant information" (p. ix). It integrates elements of many scientific disciplines such as operations research, economics, statistics, political science, sociology and psychology (van de Riet, 2003).

Policy analysis is typically practiced in conjunction with decision-making processes, that is, on the border between politics and science. In fact, policy analysis processes need contributions from both spheres (Stone, 1988). In the literature, this borderline is perceived as a wide gap. Politics is the sphere of emotion and passion, irrationality, self-interest, short-sightedness and raw power, and is considered to be 'dirty' (ibid.). Political discussions are mainly action oriented and strategic (Pröpper, 1989). To scientists, the way knowledge is used all too quickly seems to be a matter of political opportunism (Rutgers and Mentzel, 1999). Science, on the other hand, stands for reason and rationality and is therefore considered by many to be 'clean' (Stone, 1988). Scientific discussions are knowledge oriented and 'objective' (Pröpper, 1989). To politicians, science seems to be an endless endeavour in search of the truth and nothing but the truth (Rutgers and Mentzel, 1999).

Studies of policy analysis may be forward looking or backward looking. A forward looking analysis can be done to anticipate the results of alternative policies in order to choose among them, or it can be conducted to describe the consequences of a policy. This is also called *ex-ante* policy analysis. Backward looking policy analysis refers to either the historical analysis of past policies or the evaluation of a new policy as it is implemented (Patton and Sawicki, 1993), and is also called *ex-post* analysis. This research focuses on *ex-ante policy analysis processes*.

As an activity, policy analysis has structure (Wildawsky, 1979). Policy analysis processes have in common that they are modeled after the general *intelligence-design-choice* structure of (bounded) rational decision making, but end at the point where the actual decision is made. By passing through a sequence of activities, the analysts generate information that is intended to support decision making by others. The first phase in policy analysis, also called the scoping phase in which problems are analysed and defined, is considered very important and requires a lot of attention. The structure of the activitities as described above is presented in Figure 2.2. An important note that needs to be made related to this figure is that the sequence of activities is not as linear as the figure may imply. The phases can be displayed in a successive way, but it has to be realised that iteration loops exist between the different phases. Figure 2.1 gives an example of a representation of these steps. In other literature ((Dunn, 1981: Patton and Sawicki,1993), similar representations can be found. These phase models are a convenient representation to localise scale choices because in each phase important scale choices need to be made.

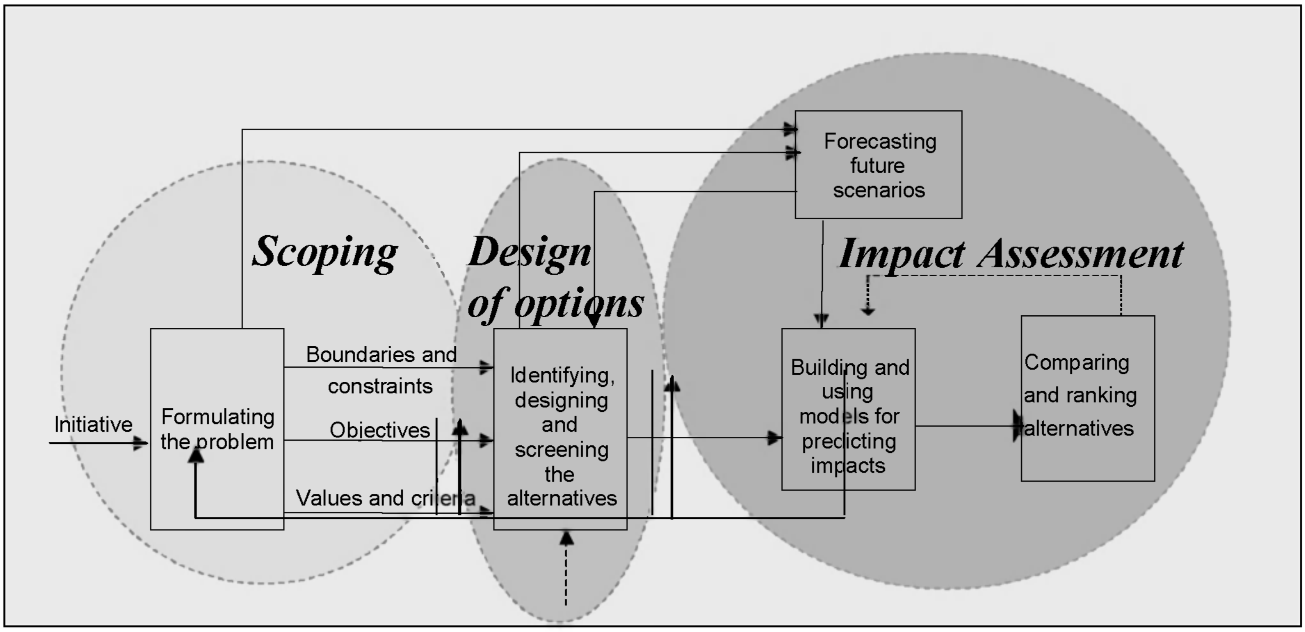


Figure 2.1: Overview of policy analysis acitivites (from Miser and Quade, 1985, p. 124)

2.3. Developments in policy analysis

2.3.1. Policy analysis in the early years

The development of policy analysis in the 20th century originated in the field of operations research in the United States of America. It started out as a military planning support activity and was originally designed for authoritative, top-down planning which fit with the image of policy making in those days as a top-down, rational activity initiated by a single actor: the government (see Figure 2.2). Policy making was assumed to be a rational process going through sequential stages whereby one stage needed to be finished before the following one started. Examples of commonly used stages were agenda setting, policy formulation and legitimation, implementation and evaluation.

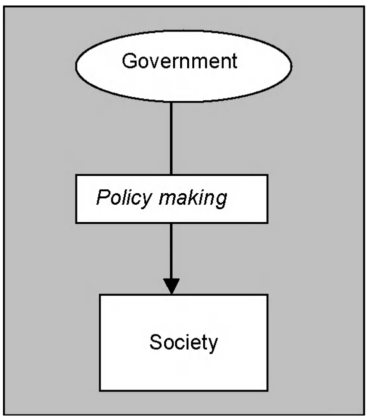


Figure 2.2: Hierarchical, single-actor policy making (van de Riet, 2003)

Policy analysis was considered the speaking of truth to power: the existence of one single truth that could not be argued (Wildawsky, 1979). In those days it was often referred to as 'systems analysis'; it had a technocratic and scientific character focusing on models and tools such as cost-benefit analysis (Hoppe and Peterse, 1998). The process was thought to end up with the 'optimal' or 'best' solution to deal with a certain problem (Hoogerwerf, 1993; Hermans, 2005). In the 1970s, policy analysis was introduced in Western Europe (Edelenbos et al., 2003).

2.3.2. A shift in policy making

Lindblom (1959) was one of the first policy scientists who disagreed with the rational perspective of top-down policy making, because of the chaotic character of the policy process. He characterised policy making as being incremental and called it *muddling through*, a metaphor that stands the wear and tear of time as it is still commonly used. The frustration of policy makers caused by decisions that appeared to be ineffective through the lack of support from actors involved in the implementation gave rise to the development of new modes of decision making amongst which come the participative and interactive ways of decision making (Kørnøv and Thissen, 2000).

In these new modes of decision making, the presence of multiple actors with divergent interests and resources is recognised. The actor's perceptions of reality is influenced by the actor's point of reference, also called subjective rationality. Policy makers are forced more and more often to involve stakeholders in the decision-making process because resources and decision-making power are spread across actors. Then, the actors become dependent on each other and need to cooperate to realise a policy (van de Riet, 2003). Other important reasons to involve the stakeholders in decision making are the growing perceived importance of the democratic character of the process, the enhancement of support for proposals, and the enrichment of the quality of the policy outcome (Edelenbos, 2000). Figure 2.3 illustrates the multi-actor public policy setting which is characterised by interactions within a network constellation of actors.

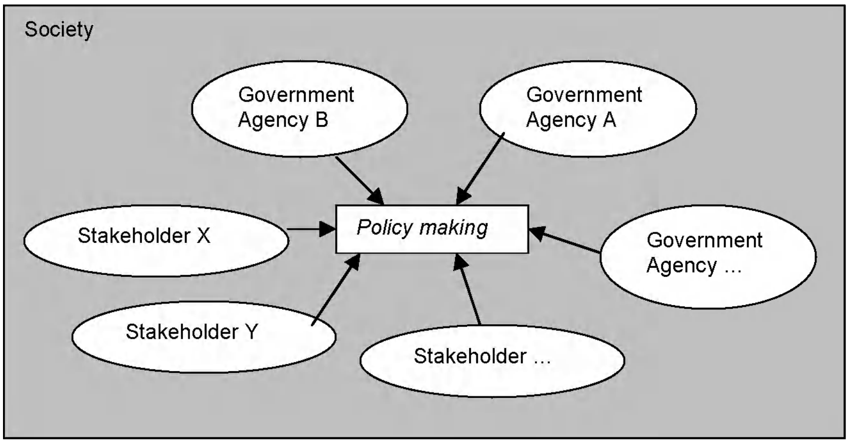


Figure 2.3: Multi-actor policy making in a network context (van de Riet, 2003)

When the multi-actor view of policy making emerged, there was a need for new theories and concepts that did justice to its chaotic character. A lot of new theories and concepts were developed. Most of these policy process models have an explaining character and no predictive power which is in line with the chaotic and unpredictive character of policy processes. Nevertheless, some of these models are highlighted here together with their lessons that are considered to be important for policy analysis. The models discussed are Cohen's garbage can model, the streams model of Kingdon, Sabatier's advocacy coalition model, the network model of Koppenjan, and Teisman's rounds model.

In the garbage can model (Cohen, et al., 1972), the garbage can is a metaphor for the decision-making process. Problems, solutions, participants, and choice opportunities are dumped in a garbage can. They cannot only flow in but can also flow out, and which problems get attached to solutions is largely due to chance. This model shows that it is important to find combinations of problems and solutions that are interesting for policy makers.

Kingdon's streams model (1984) builds upon the garbage can model with the difference that the streams model clarifies why certain problems appear on the political agenda. It is characterised by Kingdon's notion of a *policy window* which is an important issue in a new agenda setting theory. The theory makes a distincton between three streams: the problem stream, policy stream and political stream. A policy window is created when these streams come together: the opportunity arises to place a problem on the political agenda or to change policy direction. Policy windows can be created by triggering or focusing events, such as accidents and disasters, as well as by changes in government and shifts in public opinion. A policy window offers opportunities to any group able to mobilise support for a particular set of policies. The streams model shows that it is important to be prepared for policy windows and to be able to come up quickly with solutions when such a policy window occurs.

The advocacy coalition model developed by Sabatier (1988) stresses the interactions between different coalitions that advocate certain problems and solutions. Policy making is thought to be a result of competition between advocacy coalitions. Sabatier shows the involvement of multiple actors with multiple interests and multiple goals so there is not an 'optimal' solution because it all depends on the perspective. Therefore, one needs to look for common arguments to build consensus and to build a winning coalition.

In the rounds model, decision making is seen as a series of decisions made by different actors (Teisman, 1992). Decision making takes place in one or more arenas that are formed during a round. The rounds model can be seen as a compromise between the extremes of the classic phase model, that is illustrated in Figure 2.1, and the garbage can model (Carton, 2007). A round is concluded by a decision, a change in information that changes the focus of the debate or an exogenous event and, hence, initiates a new round. The rounds model shows the dynamic character and shifts in focus during a policy process. Objectives are not clear from the beginning and can also change in the dynamic process, so it can be compared to shooting a moving target. This requires a flexible and adaptive design of the policy analysis.

2.3.3. From single actor to multi-actor policy analysis

The policy models described in the section above emphasise the dynamic and chaotic character of policy making. The change in policy making towards multi-actor settings puts additional demands on policy analysis processes. During the switch from single actor-oriented policy making to multi-actor-oriented policy making, however, policy analysis at first still operated under the assumption that decision making ought to be a more rational process and that policy analysis at least had to be the rational part of policy making (Heineman et al., 1990). Others at that time recognized that there was no such thing as totally 'neutral' analysis in a multi-actor setting (Hogwood et al., 1984). Values were thought to be at the centre of policy making, and it was considered impractical or even undesirable to insulate analysis from political debate to specify values and objectives,leaving it to 'value free' analysis to produce the optimal solution (ibid.). This also relates to the most important general lesson of the switch to multi actor policy making: policy analysis is in the eye of the beholder.

There was the realisation that a problem could not be defined objectively because multiple perceptions of the problem exist. "Reasoned analysis is necessarily political because it always involves choices to include some things and exclude others and to view the world in a certain way when other visions are possible" (Stone, 1988, p. 306). Because of the presence of multiple perceptions, also the political character of knowledge was increasingly recognized: for every scientific claim, many scientists can be found to dispute it (Mayer, 1997). This recognition put the role of knowledge itself under pressure. Knowledge became negotiated knowledge (Jasanoff, 1990). Defining problems, framing hypotheses, choosing methodological designs, making methodological assumptions, selecting criteria for analysis, building and running computer models and interpreting results all involve value judgements (Cortner, 2000). Research and researchers are considered just one of many sources of authority; scientific information may itself be biased; and, other types of policy actors, information, and values are more important for arriving at sensible public choices (Ezrahi, 1980). Some even suggest that science is used for less desirable policy purposes, such as rationalising and legitimising decisions made by elites (ibid.). Also, it can be noticed that policy makers frequently call for research or form study commissions to postpone facing problems. They invoke research when it is in concert with their preferred policy preferences and ignore it when it is not (Cortner, 2000).

Concern about the limited influence of rational analysis in the policy process has had the effect of raising fundamental questions about the orientation and role of policy analysis. It seemed clear that, to be politically influential, policy analysis had to be practiced as an integral part of its broader cultural context in the multi-actor context and that the process aspect of policy analysis required a lot of extra attention. It could not continue to be a separate 'scientific' endeavour inherently entitled to the deference of politicians and citizens. Its practitioners had to understand that they were both in and of a particular kind of political world and that to maximise their policy effectiveness they had acknowledge the characteristics of that world (Heineman et al., 1990). Another important lesson for policy analysis was that arguments play a crucial role in multi-actor policy making: "Public policy is made of language. Whether in written or in oral form, argument is central in all stages of the policy process." (Majone, 1989, p .1). According to Majone (1989) argumentation is the key process through which citizens and policy makers arrive at moral judgements and policy choices. Criteria to support the arguments used in the process depend, among other things, on who one is, where one sits, and what one intends (Brewer and deLeon, 1983). The job of policy analysts consists in large part of producing evidence and arguments to be used in the course of the public debate (House, 1983). This paved the way for the so-called argumentative policy analysis: the policy analyst focuses on the construction of a logical and consistent argument for decision making instead of the use of techniques such as cost-benefit analysis and systems analysis (Hoppe and Peterse, 1998; Fischer and Forrester, 1993). One of the major difficulties is that, just like the policy models, the new policy analysis theories offer little guidance in substantive design (Carton, 2007). Mayer (1997) concluded that "the new argumentative dog cannot hunt" (p. 58).

The change from single actor perspective to multi-actor perspective had major implications for the fundamentals of policy analysis. Common terms used in the traditional policy analysis such as ‘efficiency’ got an entirely different meaning when given the multi-actor perspective. A classic example is the description of efficiency in a library system by Herbert Simon, presented in Box 2.1.

Box 2.1: Different views on efficiency in a library
If one poses the problem of how to run a library efficiently it depends on the perspective whether it is thought to be efficient or not. Clients of a library might argue that many small branches within walking distance from their homes are efficient (at least for them). Also they think it is efficient if a lot of staff is available that can help them quickly if needed. More branches would however ask for more duplication of the collection and more staff. From a library management point of view it could be argued that it is much more efficient to have one large library. Also, efficiency from a management perspective would be as few librarians as possible to provide the minimum service needed. Simon concludes that one person’s efficiency is another person’s waste (Simon, 1997).

A general shift can be observed in policy analysis from a content-oriented approach to an approach in which the process also takes an important position. However, it is also dependent on the specific context and objective of the policy analysis process as to whether the policy analyst has a position closer to the researchers (with a stronger focus on the research) or one closer to the actors in the policy process (with a stronger focus on the process). No matter whether the focus is more on the research or the policy process, policy analysis in a multi-actor context requires regularly alternating between the process and content focus.

2.3.4. Overview of differences

Drawing on US experience, Radin (2000) identified two types of policy analysts: the traditional policy analysts of the 1960s and 1970s focusing on the quantification of economic costs and benefits, and the current policy analysts who came on stage in the 1980s and 1990s concerned with the social construction of policy problems, policy discourse and the politics of the policy process. Table 2.1 shows a comparison between the two types of analysts and illustrates that policy analysis has become more comprehensive.

Table 2.1: A comparison between the traditional and the current policy analysis approach

	Traditional policy analysis approach	**Current policy analysis approach**
Policy analysts' perceptions of policy context		
Primary decision making actor	Monocentric: government controls the process	Pluricentric: government operates within a network
Problem definition	Single actor	Multiple problem perceptions
Character	Scientific, static, goal oriented	Political, dynamic, goal-seeking
Policy process	Linear, sequential phases	Non-linear, rounds (Teisman, 1992) and streams (Kingdon, 1984)
Role of knowledge	Single objective truth	Subjective claim
Ways policy analysts work		
Role of policy analyst	Information provider and integrator	Facilitator of the process, information provider and integrator
Content/ process focus	Content	Process and content
Main methods	Quantitative methods	Quantitative and qualitative methods
Characteristic disciplines	Economics, operations research, decision science	Economics, operations research, decision science *and* policy sciences, sociology and psychology
Major risk	'Superfluous knowledge' (van de Riet, 2002)	'Negotiated nonsense' (van de Riet, 2002)
Characteristic authors that are referred to in this research	Miser and Quade (1985 and 1988), Dunn (1981), Patton and Sawicki (1993)	Stone (1980), Fischer and Forrester (1993), Hoppe and Peterse (1998), Majone (1989), Radin (2000)

2.4. An overview of goals in policy analysis

A policy analysis process is aimed at having a purpose in the policy process, so it is designed for a reason and has a goal to achieve. Mayer et al. (2004) propose a conceptual model which features six major clusters of roles that policy analysts perform to support policy-making processes. This so-called hexagon model helps to create a better understanding of policy analysis as a discipline and is shown in Figure 2.4. One of the objectives of the hexagon model is to provide a framework for evaluating policy analysis methods and projects. Two clusters can be distinguished: the traditional policy analysis and the current policy analysis. The traditional policy analysis contains the roles that focus on the content (on providing information): research, analyse, design and recommend. The current policy analysis contains these roles but adds the roles that focus on the process: mediate, democratise and clarify arguments and values, and provide strategic advice.

The corners of the hexagon model display the activities and their associated values. These values are considered to be important in determining whether the goal of the policy analysis process is achieved, i.e. whether the study is successful. For example, the goal of a policy analysis process may be "to mediate in order to solve conflicts". If the conflicts are solved the conclusion may be drawn that the goal is achieved.

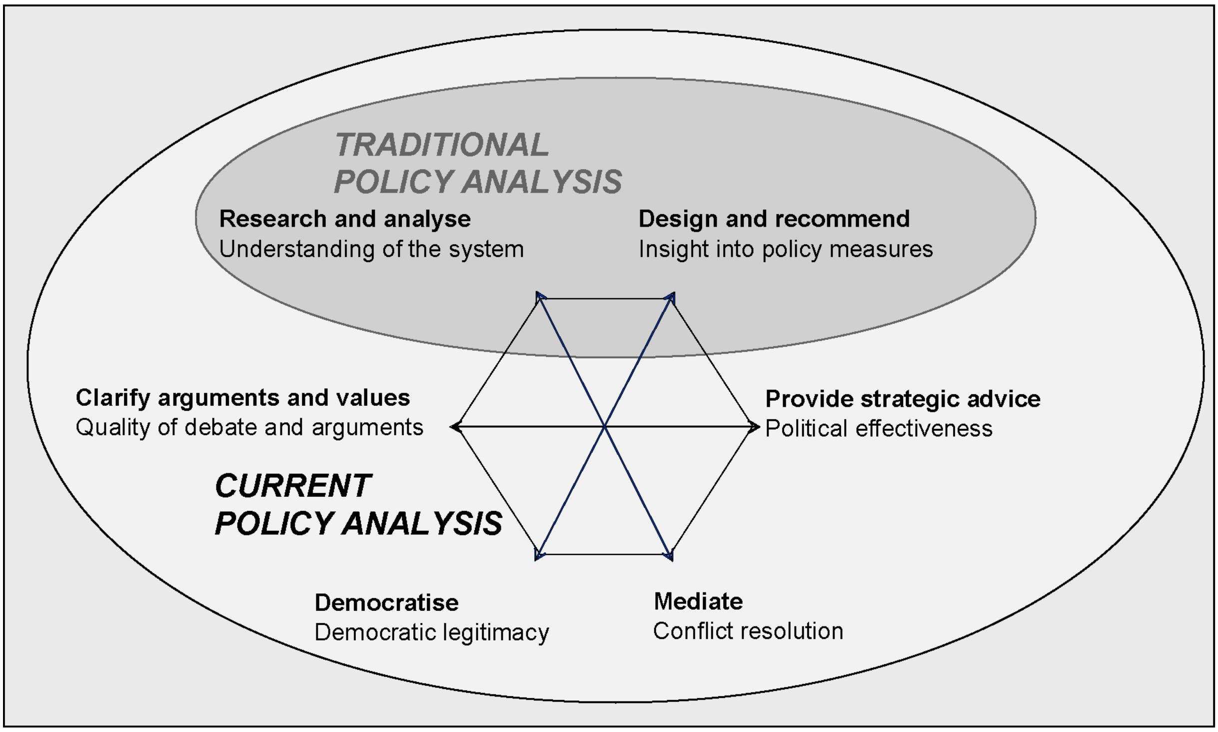


Figure 2.4: Hexagon model with roles of policy analysis and associated values (from Mayer et al., 2004)

A short description of the activities playing a role in the hexagon model is provided in Box 2.2.

In this research, the hexagon model is used to provide a basis for the evaluation of the scale choices made. The distinction in activities is very useful in identifying the general goals of policy analysis processes. It is important to recognise the goals of a policy analysis process when evaluating the scale choices made. The normative starting point that is used in this research is that scale choices should be made in such a way that they contribute to the goals that the policy analysis process wants to achieve. The hexagon model is helpful for classifying policy analysis processes and for making the goal specific that the scale choices that are made should contribute to.

Box 2.2: Description of roles of policy analysis in the hexagon model (based on Mayer et al., 2004)

Research and analyse: This role is characterised by the use of research methods and techniques that are scientific or derived from science, such as data collection techniques, mathematical modelling, and statistical analysis. An important value related to this activity is the understanding of the system. The goal *research and analyse in order to gain a better understanding of the system* is often emphasised by scientists and experts.

Design and recommend: When sufficient information has been gathered in earlier research, a policy analysis may focus on translating the available knowledge into a new policy, either by making recommendations or by making a complete policy design (Mayer et al., 2004). Recommendations will be the result of comparing the effects of different policy alternatives and weighing the options based on various criteria. Insight in policy measures and their consequences is an important goal. The goal *design and recommend in order to gain insight in policy measures and their effects* is often emphasised by traditional policy analysts.

Clarify arguments and values: Policy analysis may not only make instrumental recommendations for policy making; it may also analyse the values and argumentation systems that underpin social and political debate. Moreover, policy analysis seeks to improve the quality of debate by identifying the one-sided or limited nature of arguments or by showing where blind spots exist in the debate. This activity can contribute to an escape from deadlock situations.

Democratise: In the democratising role, policy analysis has an ethical objective: it should encourage equal access to, and influence on the policy process for all stakeholders. Experts and elites are more likely to be involved and carry greater weight than ordinary citizens and laymen. Policy analysis can try to correct this inequality by calling for attention to views and opinions typically overlooked in policy making and decision making. Often, the goal *democratise order to increase the democratic legitimacy* of policy analysis is considered to be important by governmental commissioners.

Mediate: In particular in situations with conflicts, resolving policy issues may require mediation. The policy analyst may act as a facilitator and design the rules and procedures for negotiation in a decision-making process and manage the interaction and progress of that process. The mediation may comprise different types of activities, with a focus on analysing contextual factors (stakeholders, issues, dependencies, tensions, trade-offs), and designing, and possibly also facilitating, meetings in which different stakeholders and decision makers consult and negotiate (Mayer et al., 2004).

Provide strategic advice: Policy analysis will often be a strategic activity. The substantive or procedural advice will be made dependent on the analysis of the field of forces that exist, i.e. the environment in which the commissioner and his problem are located. The policy analyst can advise the commissioner on the most effective strategy for achieving certain goals given a certain political constellation, e.g. the nature of the environment in which the commissioner operates, the likely counter-steps of opponents, and so on. A policy analyst may be asked to act as a behind-the-scenes advisor or as an advocate of his commissioner in the public arena in order to achieve the commissioner's goals.

2.5. Different rationalities in policy analysis

2.5.1. The concept of rationality in policy analysis

This research recognises the multi-actor context of policy making and the need for support to meet the demands that this multi-actor context puts on the support. This is done without compromising the rational, goal-oriented and analytical nature of policy analysis even when acknowledging criticism of the concept of rationality and the dilemmas that can exist by the presence of multiple goals and the importance of values. The reason for the focus on rationality in this thesis has to do with its focus on scale choices, how they are made and how they can be guided.

The interpretation of the word 'rational' plays a vital role here. Often, a rational approach is associated with 'traditional policy analysis' in which the emphasis is put on scientific rationality using rigid restrictions of technical means-ends rationality (Mayer, 1997). This interpretation has led to a wave of criticism of the rational approach in general, which was in fact criticism on the scientific rational approach. Nevertheless, it made the word 'rational' unpopular with those wanting to be regarded as modern practitioners of policy analysis. This confusion has to do with the fact that, like many other commonly used words, 'rationality' has come to mean many things (March, 1994). Therefore, the interpretation of rationality in this thesis will be defined more clearly.

In many of its uses, rational is approximately equivalent to 'intelligent', 'successful' or 'without emotions'. Wildawsky (1992) defines rational as 'intended, designed or purposeful'. Something happens because it is supposed to. It is used to describe actions that have desirable outcomes (March, 1994).

Debates arise about whether or not people or organisations are 'really' rational, as well as whether it makes sense to model them as such in formal models. Some people think that any kind of rationality along the lines of rational choice theory is a useless concept for understanding human behaviour. Some have argued that a kind of *bounded rationality* makes more sense for such models because of the impossibility of having complete knowledge about all the details of a given situation (Simon, 1997). According to Simon, perfectly rational decisions are also often not feasible in practice due to the finite computational resources available for making them. Another reason to introduce the notion of bounded rationality is that most people are only partly rational and are, in fact, emotional in the remaining part of their actions.

Another point of criticism on rational decision making is that in multi-actor decision-making rational procedures do not apply that easily. Individual actors can act rationally but when they have to make a joint decision it is all a matter of perspective. Although the literature has given quite some attention to the issue of rationality in multi-actor decision making (Keeney, 1993), it remains a difficult issue and different theories may apply, such as group think (Jasanoff, 1990; Janis and Mann, 1977), catch as catch can (de Bruijn et al., 2001), negotiated agreements (Scharpf, 1997), decisions happen (March, 1997) and decisions by majority vote (Scharpf, 1997).

Rahmatian and Hiatt (1989) introduced two frameworks that support this interpretation that can be used to explore the definition of the concept of rationality a little deeper: the pragmatic/ behavioural and the logical/ linguistic framework of rationality. In the pragmatic/

behavioural framework, people are regarded as purposeful systems, in the general sense that they pursue objectives and seek ways of accomplishing them. People are rational, in this context, if their actions are instrumental in enabling them to achieve the desired ends, given their assumptions and suppositions. The emphasis is placed on *objectives and means-ends linkages*. This view is closely related to the definitions of rationality by March (1994) and Wildawsky (1979) as given above.

Within the logic/ linguistic framework, *compatibility with predefined rules* is held to be the overriding criterion for assessing rationality. These predefined rules tend to be, in most cases, laws of thought discussed using classical formal logic. In this view, people are rational to the extent that they are capable of sound deductive and inductive reasoning. Next to the rules of logic, the rules and laws developed within different domains of human activity can also be used to judge the compatibility of a behaviour (Rahmatian and Hiatt, 1989). For example, according to technical rationality, action is evaluated in terms of the dictates of technology, according to an economic rationality when actions are evaluated in terms of costs and benefits. The logistical/ linguistic framework is also important for this research because it stresses the existence of different types of rationalities. Also, March (1994) links rationality to processes of choice and defines rationality as a particular and very familiar class of procedures for making choices, opening the door to the presence of different classes of procedures.

Despite all the points of criticism, it must be recognised that in order to understand the different perspectives on scale choices, the logic of their consequences, and to provide some guiding principles for the making of scale choices, the assumption must be made that actors are rational in their behaviour. Otherwise, it would be impossible to establish a relationship between the actors' perspectives, their preferences and the choices made. In this thesis, Rahmatian and Hiatt's (1989) frameworks are adopted and, therefore, the concept of rationality is used in the sense that is assumed that all actors involved in a policy analysis process make choices in a rational way but that their rationalities can differ. They may have different perspectives on policy analysis and the role it plays in the policy process, but they all want to achieve something in the policy analysis process even if they don't want the situation to change. The next question that needs to be answered is what types of rationalities play important roles in policy analysis. In this research, a distinction is made between four rationalities.

Sections 2.3 and 2.4 already explained the presence of two different orientations in policy analysis:

- A content orientation related to the action goals of research, analyse, design and recommend, emphasised by authors like Miser and Quade (1985) and Dunn (1981) This orientation is closely related to the scientific rationality in which the quality of research is a key issue (Pröpper, 1989).
- A process orientation related to the goals of mediate, democratise, and clarify values and arguments, emphasised by authors like Stone (1988) and Mayer (1997). This orientation is closely related to the political rationality in which.the protection of interests is a key issue.

Lindblom emphasises that analyses always need to be completed in the time and with the resources (for example budget) available (Lindblom, 1993). These constraints always play an important role. They also have a large impact on the making of scale choices and therefore have to be taken into account in this research. Therefore, an additional rationality can be

identified: a policy analysis process can also be regarded as a project from a managerial rationality.
Bobrow and Dryzek (1987) present another rationality involved in policy analysis: a policy analysis process itself needs to be designed because choices have to be made, clear goals have to be set, and activities/ methods for analysis and management of the process defined. An overview of the different roles and goals of policy analysis was given in the hexagon model in Figure 2.4.

Based on these concepts, in this thesis four rationalities in policy analysis are distinguished that are explored more deeply in the following sections:

- Scientific rationality
- Political rationality
- Managerial rationality
- Design rationality

It is important to recognise that the distinction between these rationalities is only conceptual; actors will in reality often use a combination of rationalities in their way of thinking and their way of acting.

As states before, it is important to make a distinction between these four rationalities because they play an important role in the making of scale choices. The perspectives on scale choices from these rationalities are essentially different, as will be shown in Chapter 3. In the following sections, first, the rationalities will be explained in more depth. In each section the definition, role of the policy analyst, key challenges and goal and view on policy analysis is clarified. Finally, an overview of the rationalitites is given.

2.5.2. Scientific rationality

Definition
Science has been defined as a method or process by which scientists explain and predict phenomena, events, or behaviours in the biophysical or social world using a certain form of rigorous, quantifiable inquiry that involves the testing of researchable hypotheses. Science is based on empirical observation and, in the best cases, experimental manipulation of natural variables (Fischer, 1990; Goggin, 1986). Scientific inquiry involves both modelling and data gathering. Scientific research is often clothed with an aura of independence and objectivity that is promoted and defended by researchers (Cortner, 2000).

Key challenge and goal
From a scientific rationality, the creation of knowledge in policy analysis plays a key role. Scientists are interested in understanding why things occur and want empirical evidence that they do occur in this way. This means that they seek to discover causal patterns in the structure of the world. The scientific validity of the results is considered to be a key value. In order to obtain scientifically valid results, scientific principles must be followed (van de Riet, 2003). The most important principles are the use of valid data, methods, techniques and models, and verifiability of the results. In general, validation ensures that ‘you make the right thing’ and verifiability makes it possible to check that ‘you made it right’.

Role of the policy analyst
The role of the policy analyst from a scientific rationality can be defined as a knowledge integrator: the policy analyst integrates the results of the disciplinary studies and translates them to provide an answer to the policy questions.

View on policy analysis
In policy analysis, validity means that methods, techniques and models should be selected and used that are appropriate to the problem (van de Riet, 2003). Also, input data should be checked. Verifiability, also referred to as repeatability, is an expectation that research findings can be replicated or reproduced with the same results by different scientists in different laboratories and using different equipment (Steel et al., 2004). In order to do so, the assumptions should be clearly stated. Verifiability means that subjective judgements should be made explicit and supported by reasons (van de Riet, 2003).

Information, expertise, models and tools are considered very important in this rationality. There is a significant focus on the models: to create new, better, more precise and more comprehensive ones. The problems are analysed preferably in great detail, often without assessing the need for that from a decision-making perspective. The search for optimal solutions is of great importance, often without realising that ‘optimal’ is defined while looking at the problem from a disciplinary scientific perspective. Impact assessments are strived to be complete, but often selective by discipline.

2.5.3. Political rationality

Definition
In political rationality, actors, their perceptions of reality, their objectives and interests play an important role (Rosenhead, 1989; van de Riet, 2003). According to de Baas (1995), achievement of goals, morality and conservation of power are three important aspects of the political rationality. Stone (1988) states that political rationality often emphasises normative considerations such as equity, liberty, democracy, justice and community, and finds its expression in conflict over wishes, preferences and visions.

Key challenge and goal
The protection of the involved actors’ interests is a key issue. Therefore, rules and guidelines have been developed for the management of these processes, called process management (de Bruijn et al., 2001). Process agreements set out the rules of the game for the policy process and are designed in cooperation with the actors (van de Riet, 2002). Next, the negotiation process takes place according to those rules. Three items play a key role, according to de Bruijn et al. (1999):

- Focus is on stakeholders
- Process is solid (objectives and a plan are the results of the process)
- Options are kept open: it must be and stay attractive for stakeholders to participate

Role of the policy analyst
The role of the policy analyst within political rationality can be defined as facilitiator/ mediator, a strategic advisor.

View on policy analysis

From a political rationality, a policy analysis process is regarded as a process in which various actors with different interests all try to get what they want. The problem analysis is limited to the problems that are hot issues that threaten or may threaten the position of the actors involved. A limited number of options are taken into account: only those options which are preferred by stakeholders and serve their interests best. The impact assessment is selective and often limited to the impacts that are affecting the interests of the stakeholders involved. The focus on models is limited. Models are used that reflect the problems and solutions of the actors involved. The models' outcomes can be used in a strategic way: if a model's results are in line with the interests of actors, the actors will stress its importance; if they are unhappy with the results because the results affect their interests in a negative way, they may start a discussion about the assumptions made and the reliability of the calculations.

Various authors point out that, besides the formal goals of a policy analysis process, a policy analysis process might also be started for strategic political reasons (Weiss,1979; van Twist and Edelenbos, 1997). These strategic goals may play an important role in political rationality because they aim to protect the interests of a certain actor involved in the policy analysis process. Strategic goals are not usually described in the reports or pronounced by the actors (Twaalfhoven, 1999) but can also influence the way scale choices are made. Actors may use (or misuse, depending on the perspective that is used) the policy analysis process to serve their own political goals. Especially actors closely involved in the problem situation may have strategic goals in mind. In studies that are executed in a highly political context, these strategic goals may play an important role. They are often linked to an individual actor while the formal goals are related to a policy analysis process as a whole except, of course, the *provide strategical advice* activity.

The following strategic goals of policy analysis processes are distinguished by van Twist and Edelenbos (1997):

- Shelving: a policy analysis process can be initiated to delay or even postpone certain processes.
- Rationalising: a policy analysis process is started to find arguments and justify policy plans, upon which the organisation has already decided.
- Hedging: gaining immunity from criticism.
- Shirking: passing the problems (temporarily) to someone else (for example to a policy analyst).
- Ventriloquising: promoting the opinions and policy of the commissioner organisation as being neutral results of the study.
- Scapegoating: the role of a lightning rod: facilitating a process of change, which is generally experienced as unpleasant and for which the commissioner would rather not be responsible.

It is important for policy analysts to realise that strategic goals may play a role in policy analysis processes and to recognise when they play a role. Therefore, the strategic goals are additionally taken into account in this thesis.

2.5.4. Managerial rationality

Definition
From a managerial rationality, project management plays an important role. Project management focuses on the questions of what changes are needed and how they can be reached. Tangible elements of the project that play an important role are the system, the structure, the planning and the procedures (Bos and Harting, 1999).

Key challenge and goal
The key challenge in project management in general is the achievement of objectives within time and budget. Steady progress is preferred over a process with unpredictable starts and stops (Grit, 2003). Bruijn et al. (1999) mention clear objectives, a solid plan and decisiveness as important conditions to achieve the objectives within time and budget.

Role of the policy analyst
Policy analysts from a managerial rationality have roles as project managers. The policy analyst is given questions that must be answered by performing a study. The policy analyst's job is to provide the best response to an issue, given available time and resources (House, 1983). These constraints are often set by the commissioner of the policy analysis process. In the literature, the managerial view on policy analysis is not explored in great depth. Van de Riet (2002) states that project management aspects like good planning and timing, and efficient use of resources can have a strong effect on the success of a policy analysis process. Often, it is assumed that project management aspects of a policy analysis process require less attention because project management skills are assumed to be present and used adequately (ibid, 2003). Also, a lot of literature is available that focuses solely on project management issues.

View on policy analysis
From a managerial rationality, a policy analysis process is looked upon as a project. The problems involved are analysed in a selective way. A distinction is made between the main issues and the side issues as much as possible, clear priorities are set. A limited number of options are studied that are politically acceptable, a solution has to be satisfactory rather than be optimal. The impact assessment is also thought to be selective as well as having clear priorities, and available models are used as much as possible. The hexagon model however does not comprise project management related matters such as constraints due to time and budget.

2.5.5. Design rationality

Definition
Design is a ubiquitous word: it appears often and in many different contexts. Design has always been a characteristic of human endeavour. There are many definitions of design and all these definitions, at a sufficiently high level of abstraction, seem very alike. Especially in engineering a lot has been written about design. Dym (1994) defines design as a goal-directed activity, performed by humans, and subject to constraints. The product of this design activity, he states, is to realise the goals, and these goals can be of great variability. Also, design is often oriented to solve specific problems. Design problems are, in general, open-ended and ill-structured.

- Design problems are said to be open-ended because they usually have *many acceptable solutions*. The quality of uniqueness, so important in many mathematics and analysis problems, simply does not apply.
- Design problems are said to be ill-structured because their solutions cannot typically be found by routinely applying a mathematical formula in a structured way (ibid.). A scientific approach, therefore, does not meet the needs. According to Dym this makes design such a tantalising and interesting subject.

Key challenge and goal

Although design in policy analysis is perceived by many to be a complicated matter, the concept of design has not received a lot of the field's attention, so far. Bobrow and Dryzek (1987) made an important contribution to the concept of policy analysis design. They say that design pursues values by recommending purposeful activities specific to place and time.
They distinguish three central elements in policy analysis design: values, context and the creation of form: "Design is the creation of an actionable form to promote valued outcomes in a particular context" (p. 201). First, the goal of the policy analysis process needs to be determined. Next, methods need to be explored about how to achieve the goal. Often, multiple methods exist that can be used to do this so there are some degrees of freedom. The consequences of different methods need to be thought through and a method needs to be selected. The consideration of many legitimate goals may also be required, instead of a single clear goal (Brewer and deLeon, 1983), which complicates design. In those cases, dilemmas exist and consequences of the different methods must be thought through.

Role of the policy analyst

From a design perspective, policy analysts can be regarded as creators, similar to architects because, in a way, policy analysts also need to be original and creative. An architect designing a new house wants his design to be functional, original and creative. A policy analyst designing a policy analysis process wants to meet the goals set by the commissioner and to contribute to the quality of decision making. What is common to both is that a creative element generally characterises design and each design activity stresses context sensitivity. The basis for creativity in policy analysis is that problems have the same status as solutions, and process and content both play an important role (Wildawsky, 1979). Means-ends relations play a very important role for this rationality. Often, the metaphor of building blocks is used that must be tailored in such a way that it fits: the sum of the parts is more than the parts alone. Therefore, policy analysis is more often considered an art or a craft than a science (House, 1983; Wildawsky, 1979).

However, large differences in design philosophy are also present between engineering, architecture and policy analysis. In engineering and architecture, generally a static environment is present with clear goals, readily decomposable problems, and tight control over the object being designed (Simon, 1981). The context, however, may sometimes be dynamic and complex. Policy analysis design, by contrast, often faces a fluid environment, goals that are complex and often obscure, problems not amenable to decomposing into independent and manageable chunks, parties riven by conflicts of values and interests, uncertainty and fragmented control (Bobrow and Dryzek, 1987), making policy analysis design extra challenging. This also involves the phase of the process. Policy analysis design usually takes place in an early phase of the policy process while engineering and architecture often play a role later in the process, when decisions to construct a tunnel or a building are already made.

View on policy analysis
From a design rationale, a policy analysis process can be seen as an artefact that needs to be designed i.e. modelled and shaped to fulfil a purpose in the policy process. The design is made before the actual study starts. It comprises a role definition (mix of type of activities in the hexagon model of Figure 2.4) and some characteristic elements that were addressed in Figure 2.1, such as scoping (problem formulation), design of options, impact assessment. Scoping is a crucial part of design because a lot of design choices are involved, such as determining the goals or objectives to be achieved by a solution, setting boundaries on what is to be investigated, making assumptions about the context, identifying the target groups, and selecting the initial approach the analysis is to take (Majone and Quade, 1980). Often, in the design rationality it is considered important to perform a broad, holistic analysis of the problems involved and to find the deeper causes of the problem, to find the problem behind the problem.
The design of options must result in a satisfying solution and depends very much on the goal of the policy analysis. A broad search of options may, for example, fit with the goal *design and recommend to gain insight in the policy measures* in order to prevent premature closure. Also, it may fit the goal of 'Mediate in order to solve conflicts' because many options may result in many trade-offs. If the options are politically sensitive, however, it does not contribute to solving conflicts but may even create them, so a limited number of options may be preferred in those situations. The impact assessment is often also broad to ensure that all elements needed for making a sound decision are taken into account. Integrated models that are relevant for the decision making are constructed that enhance understanding the process. The information is presented in such a way that it is fit for purpose: ready to be used for the decision-making problem at hand.

2.5.6. Overview of the rationalities

Table 2.3 presents an overview of the different rationalities in policy analysis and their related perspectives that will be used in this research. Table 2.4 presents an overview of perspectives on policy analysis activities from the different rationalities.

Table 2.3: Overview of different rationalities in policy analysis

Rationality	**Scientific**	**Political**	**Managerial**	**Design**
Key challenge	Providing the policy process with scientifically valid knowledge	Handling multi-stakeholder interests	Pragmatism in dealing with objectives and constraints	Creation of an actionable form to attain desired goals in a particular context (functionality)
Key goal	Creation of knowledge and truth	Protection of interests	Achievement of objectives of study within time and budget	Creation of policy relevance
Role of the policy analyst	Knowledge integrator	Facilitator/ mediator Strategic advisor	Project manager	Creator/ designer
View on policy analysis	Research	Process	Project	Artefact

Table 2.4: Overview of view on policy analysis activities from different rationalities

Rationality→ **Policy analysis activities**	**Scientific**	**Political**	**Managerial**	**Design**
Scoping: formulating the problem	Detailed analysis of the problems	Analysis of hot issues (that may threaten the position of actors involved)	Selective	Broad, holistic analysis of problems to find the problem behind the problem
Design of options	'Optimal' solution (from scientific perspective)	Limited number of options that are preferred by stakeholders that serve their interests best	Limited number of options that are politically acceptable 'satisfying' solution	Can be broad or not, depending on the goal of the policy analysis process
Impact assessment: comparing and ranking alternatives	'Complete' scientifically valid assessment (but selective by discipline)	Selective assessment (by interest) that is recognized by actors involved	Selective assessment that sets clear priorities	Broad assessment in order to ensure taking all elements that are needed into account for a sound decision
Impact assessment: models for predicting impacts	Large focus on models: Making a new, better, more precise, more comprehensive model	Little focus on models: Using models that reflect the problems and solutions of the actors involved	Using available models when possible	Integrated models that enhance understanding of the processes that are important for taking a decision
Communication of the results	'Objective' and valid information	Comprehensible information relevant to the interest of the actors involved	Timely information relevant to the decision problem at hand	Information relevant to the decision problem at hand, fit for purpose

The four rationalities play important roles in the making of scale choices, as will be demonstrated in the next chapter.

3. Scale choices in policy analysis on water management

In a world of continua, boundaries are inherently unstable...
At every boundary, there is a dilemma of classification: who or what belongs on each side?....
These dilemmas reveal intense passions because the classifications confer advantages and disadvantages,... and power and powerlessness.

Deborah Stone in Policy paradox and political reason (1988, p.309)

3.1. Preview of the chapter

The terminology surrounding scale-related concepts is less intuitive than it first appears (Haufler et al., 1999). Jewitt (1998) states that much of the lack of progress in resolving scale issues can be attributed to confusing terminology and inconsistent use of scale-related concepts. Therefore, in this chapter, first a definition of important scale-related concepts that are used in this dissertation will be given.

Section 1.2 illustrated by practical examples that different views on scale exist. It did not, however, provide an explanation for these differences. Chapter 2 showed that in policy analysis different rationalities play a role: the scientific rationality, the political rationality, the managerial rationality and the design rationality. These four rationalities in policy analysis are used in this chapter to explain different views on scale. It appears that different scale-related challenges exist that are connected to these four rationalities.

3.2. Definitions

Much of the confusion related to scale is caused by the difference between the use of scale-related terms in cartography and other disciplines. The traditional cartographic definition of scale is the ratio of map distance to the earth's surface distance (Silbernagel, 1997). In cartography, for example, 1:100,000 is a smaller scale map than 1:50,000. The former covers a larger area at a lower resolution. However, many other disciplines and typical day-to-day language use often refer to large and small scale in the reverse sense, i.e. that larger scale maps are ones that cover a large portion of the earth's surface, albeit with small detail (João, 2007; Capistrano et al., 2005; Rotmans and Rothman, 2003; Haufler, 1999). To avoid this and other potential sources of confusion, an overview of important definitions is provided in this section. Also, the definition that is used in the remainder of this research is clarified.

Scale is often intuitively used as an indication of the order of magnitude rather than as a specific value (Jewitt, 1998). In general terms, scale is the dimension used to measure or assess a phenomenon (Gibson et al., 2000). This is a very general definition and includes scales to measure temperature, oxygen content, etc. For this research, we distinguish two specific types of scale, the spatial scale and the temporal scale. Each scale has an extent and a

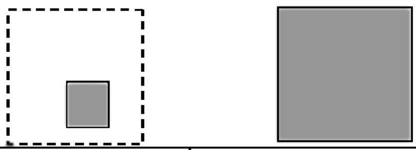
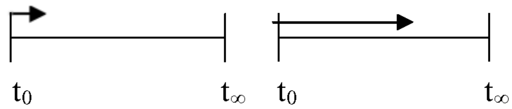
resolution. The extent is the overall size or magnitude of the spatial or temporal dimension (Rotmans and Rothman, 2003). In the case studies in this research, the spatial and temporal extent will be referred to as the spatial and temporal boundaries.
The resolution is the precision used in measurement or assessment and is also addressed as a level of aggregation. For example, a model may have the spatial extent of a country and a resolution of 1 kilometre by 1 kilometre. Similarly, it may have a temporal extent of 50 years with a resolution of 5 years (i.e. results are determined at every 5-year increment; Rotmans and Rothman, 2003). So, the resolution says something about the details taken into account. Table 3.1 provides an overview of the most important scale-related terms that are used in this research and their definitions.

A very important concept that is closely related to scale is the boundary: what is included and what is not? "A boundary is a deceptively simple term for a very complex ensemble of ideas, expectations, and theories. Some languages do not even contain a word for boundary" (Morehouse, 2003, p. 25). From a social science perspective, boundaries may serve to spatially define the limits of authority, jurisdiction and sovereignty, and map edges of identity. In physical sciences, boundary metaphors may facilitate description, locate the point at which specific conditions begin and end and define the shape and size of research domains for purposes such as data collection and analysis (ibid.).

She states that from a social science perspective, boundaries may serve at least the following functions: spatially define the limits of authority, jurisdiction and sovereignty (territoriality), and map edges of identity. In physical scientific disciplines such as hydrology, boundary metaphors may facilitate description (e.g. river basin), locate the point at which specific conditions begin and end, and define the shape and size of research domains for purposes such as data collection and analysis (ibid.). Sometimes creating a boundary between two areas may facilitate structured research. Boundaries are often taken for granted. Yet boundaries drawn for one purpose, such as the jurisdictional area of a government agency or dividing line between two sovereign states, may be irrational within other contexts such as integrated water management, according to Morehouse. Boundaries become real and acquire their meaning in political struggles. Therefore, they are constantly questioned, either because they are ambiguous and do not settle conflicts or because they allocate benefits or burdens unequally to the people on either side (Stone, 1998).

To be able to make the concept of scale more specific, it is helpful to recognise the presence of different types of scale. Different distinctions between scale choices are made in the literature. Jewitt (1998) makes a distinction between process scale, observation scale and operational scale. The process scale is defined as the scale at which natural phenomena exhibit. The observation scale is the scale at which humans choose to study natural phenomena. The operational scale is the scale at which management actions focus. Bierkens et al. (2000) distinguish an observation scale, a model scale and a policy scale. The observation scale is comparable with Jewitt's observation scale and the policy scale is comparable with Jewitt's operational scale. Bierkens deliberately does not distinguish a process scale "because everything we can say about reality is in the form of some model" (p.2). In section 3.4, a distinction in types of scale is made that is usable for this research.

Table 3.1: Definitions of important scale-related terms used in this research

Key term	Definition and explanation	Graphical representation	
Scale	Spatial, temporal or quantitative dimensions used to measure and study a phenomenon (after Gibson et al., 1998). Each scale has an extent and a resolution (Rotmans and Rothman, 2003)		
Scale choices	For this research the following types of scale choices are distinguished: • Spatial boundary setting • Temporal boundary setting • Selection level of aggregation (spatial or temporal)		
Boundary	Extent of scale; definition of limit, shape and size (Morehouse, 2003)		
Spatial boundary	The extent in space. Eg.: national, regional or local	 Small spatial boundaries	Large spatial boundaries
Temporal boundary	The extent in time Eg. For temporal boundaries: 1 year, 10 years, 100 years ahead	 Short term	Long term
Level of (spatial) aggregation	Amount of spatial detail taken into account. (also referred to as resolution or grain size)	 Detailed (low level of aggregation, small grain size, high resolution)	Abstract (high level of aggregation, large grain size, low resolution)
Level of (temporal) aggregation	Amount of temporal detail taken into account. (also referred time steps, for example hourly or daily variations in temperature).		
Scaling	Changing the extent and/or the resolution in spatial scale, temporal scale or level of aggregation For example broaden or narrow the scope of analysis; aggregating the results.		
Types of scale	Process scale, observation scale and operational scale (Jewitt, 1998) Observation scale, a model scale and a policy scale (Bierkens, 2000)		

3.3. Scale-related trends in water management

3.3.1. Global scales and cross-scale interactions

In the last few decades, it was often perceived that the systems of the earth were very complex. This recognition of complexity caused the perception to grow that processes at different scales are interconnected. Large systems can comprise smaller systems in a hierarchical or nested way. Issues playing at different scales that are linked together are also referred to as cross-scale interactions (Cash and Moser, 2000). Because of the recognition of the interconnectedness of scales, insight has also been growing that larger spatial scales should be considered when taking actions. Also, in temporal scales an increase in scale can be recognized. Humans are not used to thinking of time scales longer than one or two generations. However, some ecological, morphological and geological processes operate at very slow rates. More and more, however, the cumulative and long-term effects of water management problems are being recognised. Temporal scales that need to be used in river basin planning may be quite long, for example, to evaluate the effects of decisions on ecology or morphology (e.g. 50-100 years), while economical effects can only be evaluated on relatively small or short temporal scales (e.g. 10 years).

Not only in the physical systems the cross-scale interactions are recognised, also in the social systems they play an important role. As Williams (1999) says: “No one scale adequately explains societal processes, like capital mobility or labor strikes, because they operate simultaneously on different scales (p.51).

Global and international processes are perceived to interact with developments on the national and regional scales, and visa versa (van Asselt and Rotmans, 1999). Processes have become so interwoven that many actions, although local in origin, are regional and global in their effects (Folke et al., 1998). On the other hand, global issues may also have local consequences. Climate change is a good example of the interactions between different spatial scales. Global climate change alters river discharge which alters regional water availability of an aquifer, local groundwater recharge rates and local inundation rates; so, processes on a global scale can cause effects on a local scale. Conversely, many processes at the local scale (e.g. individual car use) can cause problems that manifest themselves on a global scale because they may contribute to climate change.

Because of the presence of cross-scale interactions, it is increasingly recognised that environmental management problems have to be tackled simultaneously at several levels, also referred to as multi-scale approaches (Berkes, 2002). Just as addressing problems from the perspective of a single discipline or sector can result in an incomplete and often problematic picture of society and societal concerns, so can focusing on a single scale and ignoring the interactions between and across scales (Rotmans and Rothman, 2003). *Think globally, act locally* is a slogan that is well known in this context nowadays and tries to raise awareness of the cross-scale interactions. The slogan was originated by René Dubois as an advisor to the United Nations Conference on the Human Environment in 1972. It refers to the argument that global environmental problems can turn into action only by considering ecological, economic, and cultural differences of our local surroundings. This recognition of cross-scale interactions results in an extra challenge when making scale choices: when a multiple range of scales may be appropriate, multi-scale approaches sound very logical but, nevertheless, some choices have to be made about what to take into account and what not. It is impossible to take the whole world into account because then it would be impossible to see the trees for the forest.

3.3.2. Small is beautiful

Although the environmental problems are perceived to play out on an increasing spatial and temporal scale, a paradigm called *Small is beautiful* (Schumacher, 1973) or *New regionalism* (Herrschel and Newman, 2002; Keating, 1998) exists in governmental institutions; it seeks to place jurisdictions at the local or communal level. This paradigm goes way back: there is a long line of thought arguing the virtues of small political systems. The ancient Greeks already agreed that a good poliical system had to be small in territory and population (Dahl and Tufte, 1973). Although it is often thought that the mountaineous geography stimulated the existence of city states a lot of political arguments are given in favour of smallness. "Smallness, it was thought, enhanced the opportunities for participation in and control of the government in many ways" (ibid., p. 5). A very good chance was present to be chosen in an administrative body and it was possible to know each other and each others'qualities (ibid).

In recent times, societal policy shifts are forcing policy makers to make decisions increasingly on a more local basis because of decentralisation processes. This trend is based on the subsidiary principle: matters should be handled by the smallest (or, the lowest) appropriate and competent authority. The central authority should have a *subsidiary function*, that can be defined as performing only those tasks which cannot be performed effectively at a more immediate or local level (Oxford English Dictionary, 2000). The national ministries delegated some of the tasks that were traditionally performed on a national level to the regional and local governments and the water boards. Small jurisdictions are more transparent to their constituencies and thus politically more acceptable. Also it is thought that bottom-up regionalisation allows better response to economic geography and greater responsiveness per se (Herrschel and Newman, 2002). Controls exerted through local peer pressure are tighter and more efficient than distanced prescriptions on which large jurisdictions have to rely. Furthermore, responsibility and authority, which must be linked, can be coordinated under one local governmental organisation or explicitly articulated between the limited range of actors involved (Lovell et al., 2002). Small units mitigate the transaction costs of organising for collective action and are generally associated with mutuality of interest and greater social cohesion that arises from easy day-to-day contact. However, the "Small is beautiful" approach can result in a multiplicity of fragmented jurisdictions that lack coordination when it comes to addressing bigger problems at a larger scale (ibid.).

3.3.3. Mismatch in physical and institutional scales

It is very difficult for human beings to think on a global scale because of all the complex relationships that need to be taken into account, and it is even more difficult to act on a global scale because no formal governmental organisations, also called institutions, with sufficient power exist on that level. This introduces an extra problem in the making of scale choices: the scales of the physical systems and the institutions do not match. The *Small is beautiful* paradigm even amplifies the problem of mismatch. These spatial disconnects are obvious according to Meadowcroft (2002): environmental problems do not respect political boundaries, instead they cut across established jurisdictions. The same characteristics apply to water management problems: rivers do not stop or begin at a state boundary. Water just flows from the highest point to the lowest point, the sea. There is a widespread concern that the scale of institutions to handle environmental dilemmas is inadequate (too small), particularly in relation to challenges such as climate change, biodiversity loss or water management. Organisations for river basin management are most likely to be effective if their structure matches the scale of the problem.

This mismatch in scales is being recognised more and more. Different countries recognise the importance of setting joint norms and regulations to attack the ever-growing global problem of climate change. To compensate for the lack of global institutions, national governments choose to cooperate by signing treaties like the Kyoto-protocol. In this way Dubois' popular slogan can also be used the other way around: *Act globally and think locally*. Act globally in signing treaties like the Kyoto-protocol, but also think locally about the needed societal support to put these important treaties into action. Nevertheless, the power of these treaties is limited because the countries cooperate on a voluntary basis, which results in the fact that some countries persist in refusing to sign despite the political pressure on them, while other countries that have signed don't make a lot of effort to reach the target goals. So, the lack of an institution with authority on a global scale is still present.

Not only in space does the mismatch between physical and social scales become apparent, also in time a similar mismatch can be observed. There is widespread criticism of 'short-termism' built into contemporary politics - that electorates are pre-occupied with immediate issues (such as the economy, crime or health care), while politicians rarely think beyond the next election, often only a couple of years away (Meadowcroft, 2002). The difference between the horizon of politics with the rate at which ecological, morphological and geological processes operates is therefore very large. Management efforts should also consider the temporal scale of the various processes they seek to respond to. Critics complain that governments have trouble responding at relevant spatial and temporal scales.

3.3.4. Responses to the mismatch

Four types of responses in reaction to the mismatch between the physical and social scales can be distinguished:

- Governmental response: big government
- Legislative response: scaling up
- Multilevel governance
- Hands-on response: conscientiously dealing with the mismatch and related dilemmas

These three types of responses are discussed underneath.

Governmental response: big government
Some critics have even called for a radical redrafting of the institutional boundaries to coincide more closely with ecological realities (Sale, 1980; Dobson, 1995). *Big government* is an approach of comprehensive authority located a few nodes across the spectrum of expanding scale requirements. It is often promoted by actors that use the physical system as a starting point. It arises in response to developing insights about ecological interconnectivity, resource scarcity, and an expanding global economy. It carries with it a strong internal logic; interrelationships of scale are best managed by unitary jurisdiction, or by a few integrated jurisdictions (Lovell et al., 2002). Also, the efficiency of a large management scale is regarded to be high (Schumacher, 1973). Another advantage of big government is that the

"greater the size, the greater the variety of parties and interests, and hence the less the probability that a majority of the whole will have a common motive to invade the rights of other citizens" (Dahl and Tufte, p. 10-11).

Although little signs of radical redrafting exist, some changes in institutional boundaries can be observed:

- *The installation of international river commissions and river basin institutions*
  On an international scale, the needs of the larger institutions has been recognized and has resulted in the appearance of river commissions to deal with river issues. One of the earliest river commissions was the International Commission for Protection of the Rhine (1950) that was installed to reduce the pollution in the Rhine River. In 1994 the International Meuse Commission and in 1995 the International Scheldt Commission were installed. In South Africa, river basin institutions have recently been created, like the Incomati commission, to be able to deal in a more integrative way with the large-scale challenges of entire river basins. These commissions, however, have limited power.
- *The merger of the water boards (water management institutions) in the Netherlands*
  In 1850, the Netherlands counted almost 3500 water boards. In 1950 mergers reduced this number to 2500. After the great flooding disaster of 1953, the call for larger water management units caused a significant reorganisation resulting in a decrease of water boards to 50, in the year 2000. Another reorganisation caused by the fact that the problems the water boards were facing were getting more and more complex (van den Heuvel, 2001) resulted in a decrease in board numbers to 27 in 2005. Large water boards are thought to be better equipped than smaller water boards to handle this increasing complexity amongst others because the employees can be more specialised. Another reason was to prevent local interests from dominating the practice of water management. The economy of scale was another important reason for this upscaling process. The impression exists that larger organisations are more efficient in their operation (Schumacher, 1973). Some disadvantages of the merger can also be recognized: the distance between the water boards and the inhabitants increases so the inhabitants feel even less dedicated and the bureaucracy increases in those bigger organisations.

Redrafting can also be done less drastically by building small units based on local interest groups into bigger coordinated units. A related question is where best to start: create big institutions and define small units on the basis of a subdivision of big units, or whether small units based on local interest groups should build into bigger coordinated units, the top-down approach or the bottom-up approach. In the former, communities usually end up with responsibilities without corresponding authority. In the latter, lack of capacity in lower- and middle-level institutions, and ineffective links between the two, are often key constraints (Lovell et al., 2002).

Legislative response: scaling up

In recent European legislation, an increase in scale can be noticed as a result of the increased awareness of cross-scale interactions. The EU Water Framework Directive prescribes river basin management planning for all river basins in the EU, and includes all waters such as polder areas, estuaries and coastal waters and groundwater. It stimulates integrated management in a transboundary context and emphasises the interconnectedness between the upstream and the downstream areas of the river. River basin management can be described as the management of freshwater systems (groundwaters and surface waters and ecology) as part of the wider environment and in relation to the different socio-economic uses that are made of this environment – if necessary across administrative borders. A major challenge of river basin management is to clarify the linkages at different scales and to produce relevant information for the different stakeholders involved in the different sectors at the appropriate scales.

Multi-level governance

Governance can be defined as "aiming at solving collective problems by means of involving the relevant stakeholders" (Finger et al., 2006, p.188). Traditionally, governance therefore involves both actors and policy (see Figure 3.1a). Multi-level governance is a public administration approach that originated from studies on European integration. Multi-level governance characterizes the changing relationships between actors situated at different scales or levels, both from the public and the private sectors. Levels have a dynamics of its own. Multi-level governance recognises that different levels have their own identity and function: the local level is most recognised for its legitimacy and for its effectiveness. The national government provides solidarity, identity and a function of external representation given that it is the national government that is recognised as the main legal entity at the international level. The regional level has generally been neglected but is now increasingly acknowledged as being important because of it is effective response to globalisation (Finger et al., 2006). The concept of multi-level governance is visualised in Figure 3.1b. The multi-level governance approach crosses the traditionally separate domains of local, regional, national and international politics and highlights the increasingly fading distinction between these domains. An early explanation referred to multi-level governance as a system of continuous negotiation among nested governments at several scales and described how international, national, regional, and local governments are enmeshed in territorially overarching policy networks (Marks, 1993). The approach emphasized both the increasingly frequent and complex interactions between governmental actors at different levels and the increasingly important dimension of stakeholders that are mobilized. As such, multi-level governance raised new and important questions about the role, power and authority of institutions.

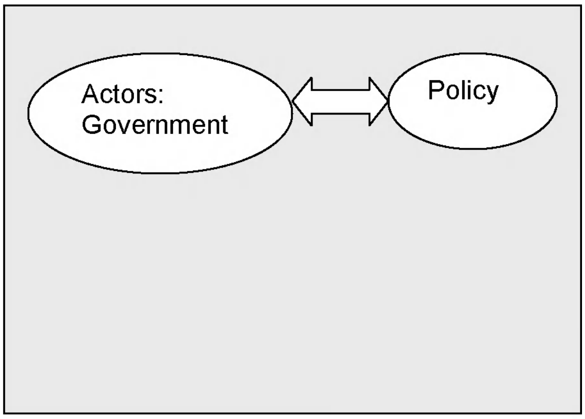


Figure 3.1a: Governance

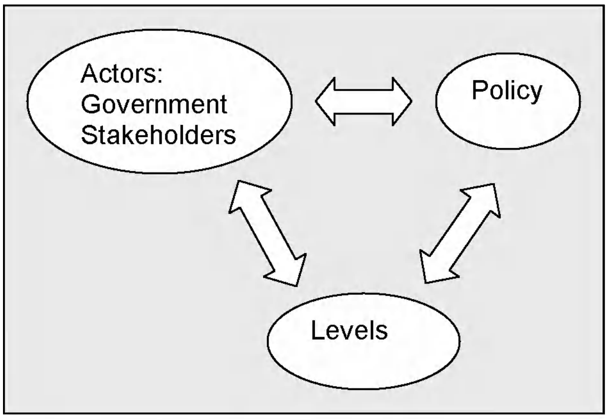


Figure 3.1b: Multi-level governance

The management of the IJsselmeer is a good example in the Netherlands where multi-level governance is a large challenge. In the management of the IJsselmeer a large variety of institutions on different spatial scales is involved:

- National scale: the Ministries Transport and Water Management, Environment and Spatial Planning and Agriculture, Nature and Food Quality play a role
- Regional scale: three provinces (Noord-Holland, Flevoland, Friesland), three water boards and three regional directorates of the Ministry of Transport and Water Management

- Local scale: numerous municipalities (Amsterdam and Almere play a dominant role. (Jørgensen and Beets, 2006)

This institutional complexity decreases the action ability. The challenge ahead is to to make agreements on the role of the actors at different levels and to create efficient vertical links to enhance the action ability.

Hands-on response: conscientiously dealing with mismatch and related dilemmas
If no institutions and legislation exist at the scale that problems need to be addressed, the tensions need to be resolved in the process itself. Dealing with the mismatch between present institutions and the relevant system scale is quite complicated. Also, the perceived relevance of larger scales often leads to an increase in options in the process of making scale choices. Sometimes, there may be good reasons to use a large spatial and/ or temporal scale, and sometimes there may be good reasons to select a small spatial and/ or temporal scale. A purely local-scale assessment, for instance, may discover that the most effective societal response requires action that can occur only on a national scale (such as the removal of a subsidy or the establishment of a regulation). Moreover, it may lack the relevance and credibility necessary to stimulate and inform national or regional changes. On the other hand, a purely global assessment may lack both the relevance and the credibility necessary to lead to changes in ecosystem management at the local scale where action is needed (Sarukhán and Whyte, 2003).

The complexity of making scale choices is also increased due to recognition of the interactions between processes at different scales and the desire to do justice to these cross-scale interactions. The dilemmas caused by the mismatch in scale between the institutions and the physical systems, the increase in options and the cross-scale interactions emphasise the need to select scale choices conscientiously and carefully.

3.4. Scale according to different rationalities

The four rationalities that were introduced in the previous chapter play an important role in the making of scale choices. The views on scale choices from these rationalities are essentially different. From the scientific rationality, the key attributes of the system under study should play an important role in the making of scale choices. For physical, social, political, and economic systems characteristic spatial and temporal scales have been determined, which may vary widely in extent. In science, therefore, in most disciplines consensus exists on what relevant scales are and at what scales certain problems need to be studied. So, from this perspective scale choices are not regarded as free choices anymore but as system related characteristics.

From a political rationality, scale choices are regarded more as a social construct. A social construct is an idea which may appear to be natural and obvious to those who accept it, but in reality is an invention or artefact of a particular culture or society (Berger and Luckmann, 1966). For every problem that is studied a new scale choice needs to be made. The implication is that social constructs are human choices rather than laws resulting from nature. It is however recognised that the alternatives for scale choices are often limited by the jurisdiction of the governmental political actors. Therefore, the decision making scale plays a crucial role in the political rationality. The decision making scale is closely related to the policy scale of Bierkens et al. (2000) and to the operational scale of Jewitt (1998) that was presented in Section 3.2. In the political rationality, multi-stakeholder interests can be distinguished that result in multi-stakeholder views on scale.

In the managerial rationality, practical limitations on scale can be recognised, such as availability of time and budget. In this rationality, scale is regarded as a scoping instrument to define what is included and what is not.

According to the design rationality, different choices related to scale have to be made in the design of a policy analysis. Bierkens et al. (2000) and Jewitt (1998) already made a distinction in different scales that was presented in Section 3.2. Their focus is however different: they focus on studies with a research character while this thesis focuses on policy analysis processes. In the conceptualisation of the design rationality in this research, only scale choices are taken into account that can be influenced by the designer of the study, the policy analyst. The following distinction in scale choices are subsequently made in the design rationality in this research:

- Observation scale: sampling, modelling (together because they are interrelated)
- Analysis scale: for problem analysis, design of options and assessment of impacts
- Presentation scale: this scale is linked to the decision making scale, because the results of a policy analysis process will be presented on a scale that is relevant for policy making/ operational decision making.

Table 3.2 shows a preview of different views on scale. In the next subsections, these four views are studied extensively because it is expected that they have a large influence on the making of scale choices in policy analysis processes.

Table 3.2: Preview of different views on scale

Rationality	View	Characteristic scales playing a role
Scientific	Scale as a system related characteristic	System scale
Political	Scale as a social construct; an instrument to get what you want	Decision making scale
Managerial	Scale as a scoping instrument limited by boundary conditions	-
Design	Scale as design decisions in a study	Scale choices: observation scale, analysis scale and presentation scale

3.5. Scale according to the scientific rationality

3.5.1. System scales

Integrated water management necessitates the consideration of views from different disciplines dealing with the physical and the human systems (see also Figure 3.2) Sciences related to the physical system are hydrology, morphology, ecology, geography and meteorology. Sciences related to the human system are economics, spatial planning, sociology and policy sciences.

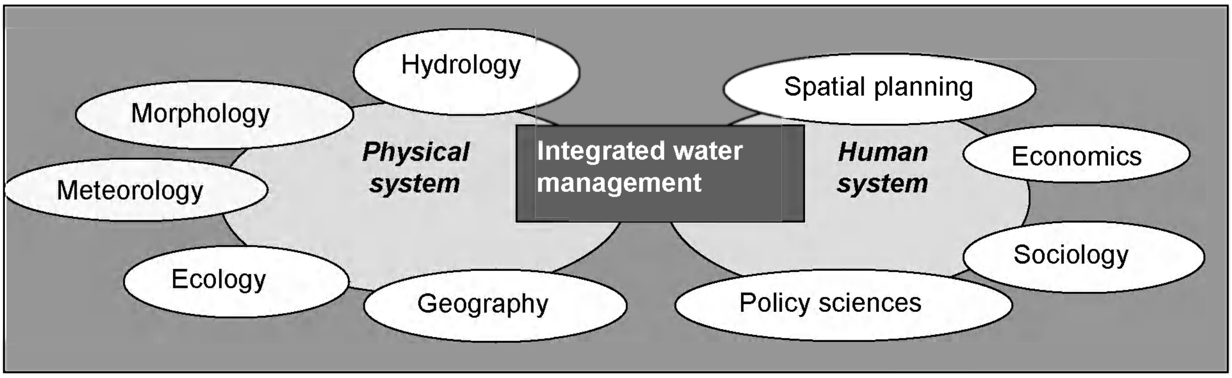


Figure 3.2: Overview of important disciplines involved in integrated water management

In the various disciplines, different views on scales exist. A geologist, for example, looks, by nature, at a much longer time scale than an economist does because of the different temporal scales of the processes that play a role in each field. These characteristic scales are often referred to as the system scale. Both physical systems and human systems exhibit characteristic spatial scales. Also, physical processes and human processes exhibit characteristic temporal scales. A characteristic scale is the average extent (spatial scale) or duration (temporal scale) over which the systems and processes have an impact (Capistrano et al., 2005). In the scientific rationality, the system scale plays a crucial role. The presence of many different disciplinary views is, according to Gibson et al. (2000), the reason that very few strong general propositions related to scale have emerged to date.

Within the physical sciences, scale has been recognised for a long time. A long tradition of attention to space and time dimensions in ecology, geography and hydrology has produced a relatively sophisticated view of the difficulties involved (ibid.). Researchers within the physical sciences are accustomed to working with hierarchical systems of analysis with scales that are explicitly named within a discipline. Also, the intrinsic relationship between time and space scales has been recognised for a long time. Figure 3.3 illustrates that each phenomenon has a characteristic spatial and temporal scale, and their intrinsic relationship.

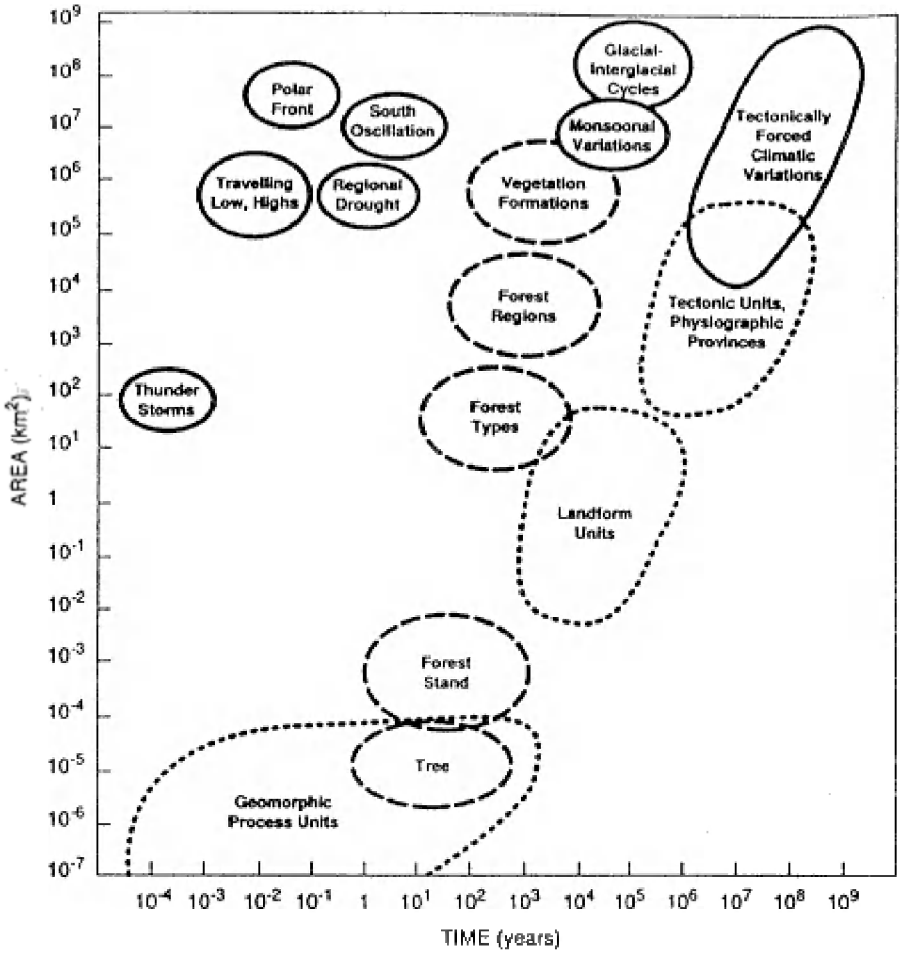


Figure 3.3: Relation between time scales and spatial scales in sciences related to the physical system (geology, ecology and geomorphology) (Jewitt, 1998)

A clear distinction can be made between the physical sciences and the social sciences regarding scale choices: scale choices get much less attention in the social sciences because social phenomena may not always include clear hierarchical systems. Therefore, social scientists have worked with scales of less precision and greater variety (Gibson et al., 2000). The different disciplinary views on scale choices are highlighted below. A distinction is made between sciences related to either the physical systems or the human systems.

3.5.2. Scales in sciences related to the physical system

The physical system scale is often thought to be inherent to the system under study and cannot, therefore, be selected. The question that needs to be asked is what the relevant system is or what the relevant systems are with regard to the objective of the study.

Knowledge of the scale at which a system is functioning and the response time of a system are important for the ways measures can be executed, for example in the clean up of pollution in rivers. Diffuse pollutants in the surface water require a larger scale approach than point source pollutants (Leijnse, 1996). The time scale is closely related to the spatial scale: the dynamics in time is different for different spatial scales. Large systems have, in general, a slower response than small systems which have a daily or seasonal variation. Thus, big systems are often slow, and small systems are often fast (Scholes, 2002; Holling, 2001).

Scale classifications are often used in the field of water management and related sciences. With the help of scale classification, a *common base for understanding* can be created because the information can be organised and analysed in a specific manner (Jewitt, 1998). One of the most accepted approaches for classifying scales is based on hierarchies. A hierarchy is defined by Haufler et al. (1999) as a formal organisation of various spatial or temporal sizes or levels graded from small to large. The hierarchy theory is based on the assumption that to be able to understand any complex system it is necessary to understand the constraints at higher and lower levels of spatial-temporal resolution (Evans, 2003). The levels immediately above and below the referent level provide environmental constraints and produce a constraint ‘envelope’ in which the process or phenomenon must remain (O’Neill et al., 1989). The hierarchy theory is often used in ecological research. Figure 3.4 shows a visualisation of the hierarchy theory. In water management this hierarchy approach can be used as well by distinguishing entities like river basins, branches and channels.

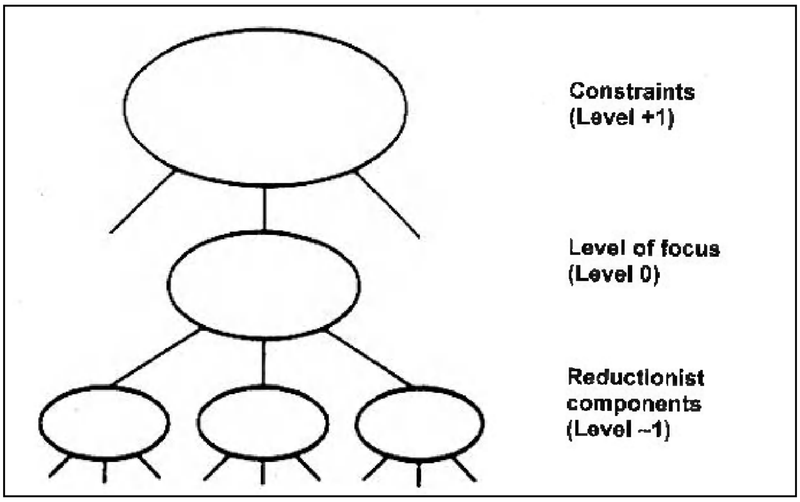


Figure 3.4: Hierarchy theory (Haufler et al., 1999)

Scales in hydrology

In hydrology, a large difference in temporal scales exists between the surface water hydrology and the groundwater hydrology (also called geohydrology). The temporal scales of hydrological processes may range from small, for highly dynamic process such as the river discharge to the sea that takes a few days, to very large for processes with slow dynamics such as the diffusion and dispersion of contaminants in the groundwater that may take many years. Examples of spatial scales are rivers, branches and channels. Figure 3.5 shows the characteristic spatial and temporal scales of typical processes in hydrology. The close relationship between time and scale can be noticed by the diagonal lines that are visible: often, large spatial processes operate generally on a large time scale.

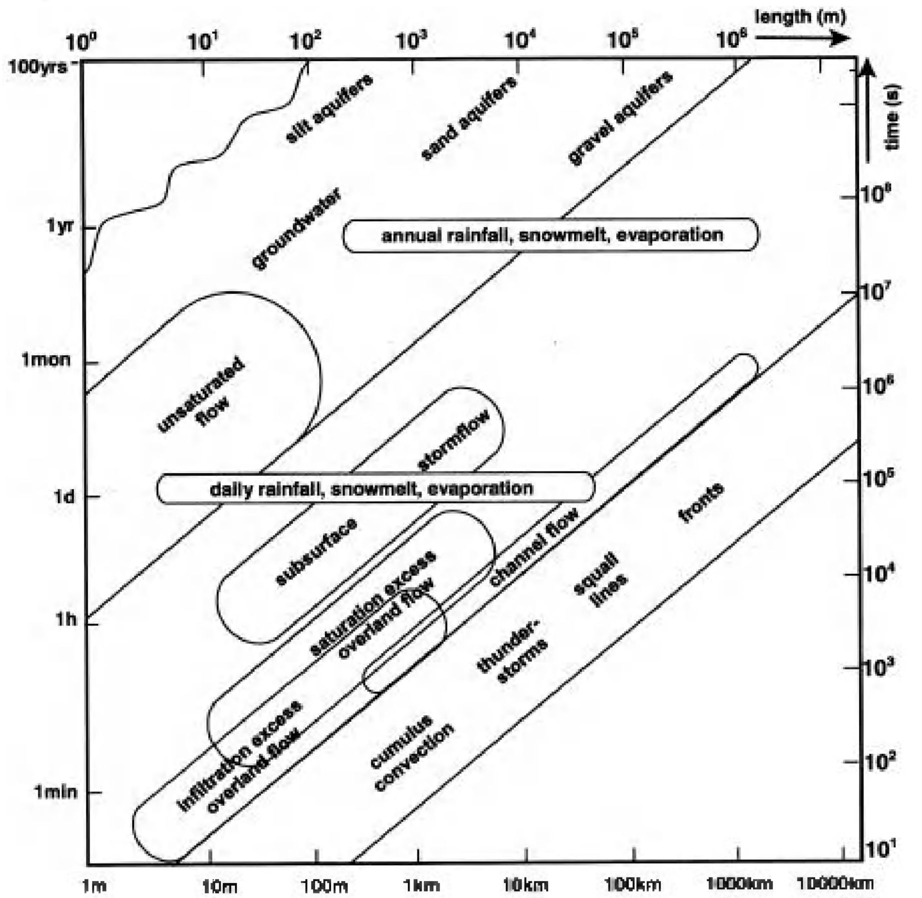


Figure 3.5: Space and time interrelationships of processes relevant in hydrology (Blöschl and Sivapalan, 1995)

Scales in morphology

In morphology, a commonly used distinction in spatial scales is between river system, estuary, coast, reach, segment and unit. Temporal scales that are relevant in morphology vary from short term to very long term: the wave period, the tidal period, the settling time of suspended sediment, the period of a channel migration cycle, etc. (de Vriend, 1999). In morphology, small-scale features like wave ripples have fast dynamics. They exist for minutes to hours. At the largest scales, climate and bio-geographical processes alter the large-scale channel structure and dynamics across hundreds of kilometres over thousands of years (ibid.).

Scales in ecology

The distribution and abundance of different species and their relationship with physical, chemical and biological features across the earth play an important role to explain the relationship between living organisms and their surroundings (Begon et al., 1996). There is no single, natural scale at which ecological phenomena should be studied; systems generally show characteristic variability on a range of spatial and temporal scales. Processes can take place in the biosphere or on the ecosystem level, community level, population level or individual species level (van der Veen and Otter, 2003). It should be noted that there is often no specific reference to space, but more to organisational levels. The entities that are often distinguished are ecosystem, community, population and individual species.

Some ecologists think that the ecological system should be studied very locally because of the variations that occur and the specific flora and fauna that can be locally distributed, while others think that ecology should mainly deal with biodiversity issues and studied on a large scale.
Characteristic spatial scales in ecology are amongst others set by the area over which a disturbance occurs and the distance over which material is transported within its characteristic time scale. For instance, carbon dioxide can be transported all over the atmosphere in its multi-year, effective lifetime, so the characteristic scale is global, while the same wind fields can only transport tropospheric ozone a few hundred kilometres before it is consumed by atmospheric reactions; thus, its characteristic scale is regional (Scholes et al., 2002). Ecological characteristic temporal scales are set by the lifespan of organisms, the turnover rate of material pools, and the average period between disturbances at a location. In ecology, space and time are closely linked. Ecological processes that operate over large areas also tend to operate over long time scales (van der Veen and Otter, 2003). Ecologists are usually interested in long time horizons and especially the long-term implication of human action (Bockstael, 1996).

Levin (1992) argues that the problem of pattern and scale is the central problem in ecology. Applied challenges, such as the prediction of the ecological causes and consequences of global climate change, require the interfacing of phenomena that occur at very different scales of space, time and ecological organisation.

Scales in (physical) geography
Scale has always been a central issue in geography (Montello, 2001). The spatial scale (resolution and extent) is recognised in geography as the main mechanism whereby patterns can be analysed and explained (van der Veen and Otter, 2003). Geographers have found that the consideration of scale problems is fundamental to the identification of patterns and their explanation. In spite of the ongoing debate about the appropriate scale at which geographic processes should be analysed, a widespread agreement exists that explanatory variables for a given phenomenon change as the scale of analysis changes (Gibson et al., 1998). Meentemeyer and Box (1987) discuss some apparent determinants and constraints of the selection of spatial scales in the field of geography. They mention, amongst others, the size and speed of a spatial phenomenon or process, the existing maps and map scales, scales of aerial photography and remote sensing images, mathematical-statistical constraints, data handling thresholds (time, technology, money), practical-empirical considerations and arbitrary selection.

Scales in meteorology
In meteorology, extremely different scales are used, contrary to a lot of disciplines that use a continuum of scales. Either processes on a relatively small scale on a very short term are studied, like the weather prediction over a couple of days in a country, or processes on a global scale over a very long term are studied, such as climate change in decades and centuries. Figure 3.6 shows the interactions of the spatial and temporal scales in meteorological processes. It clearly shows the wide range of spatial and temporal scales covered by those processes.

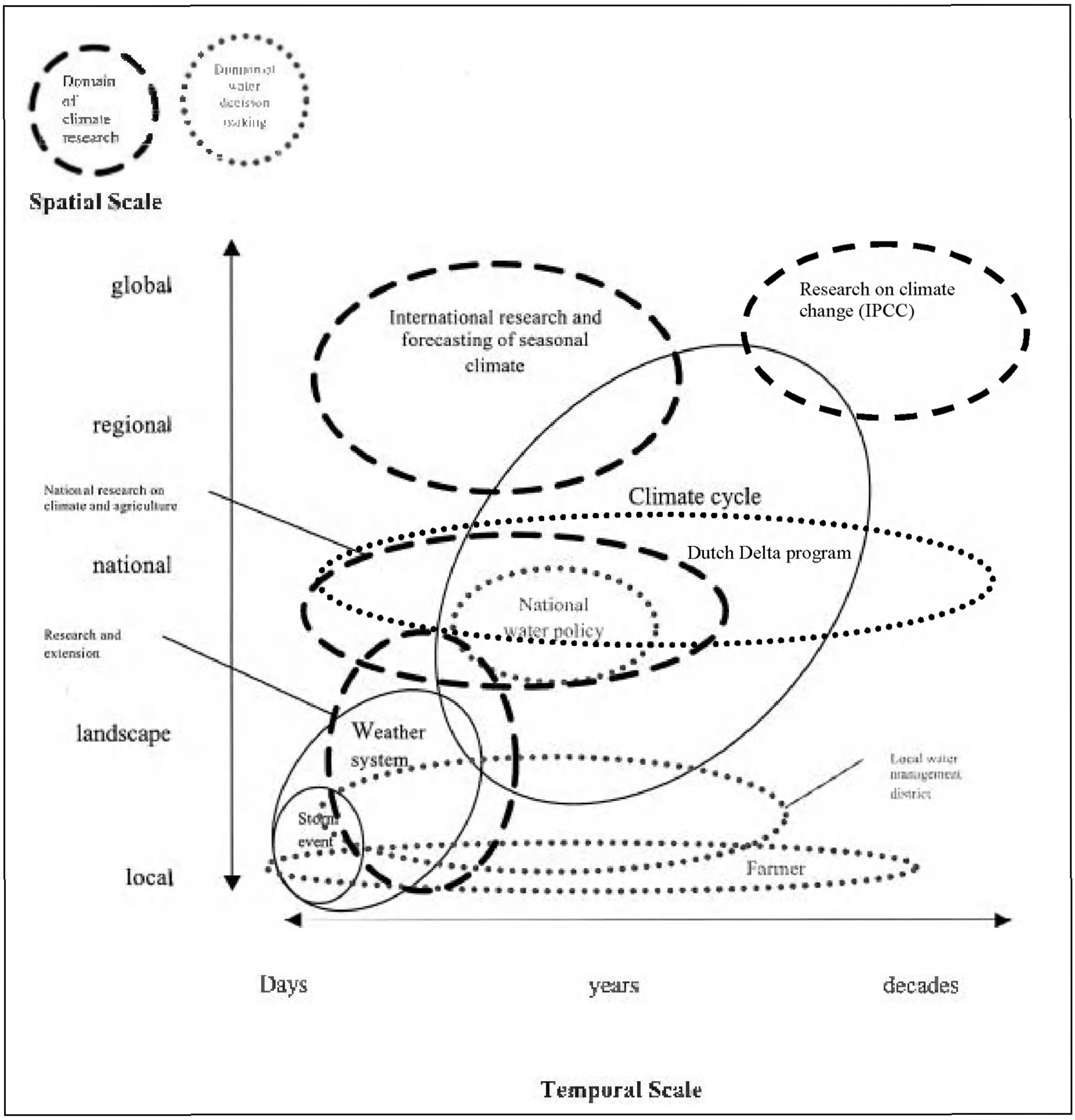


Figure 3.6: Interactions of spatial and temporal scale in meteorology (from Clark, 1987; Lebel, 2004)

3.5.3. Scales in sciences related to the human system

Scales in sociology

Sociology is a social science involving the study of the social lives of individuals or groups at different scales: for example, households and societies. Until recently, scale has not been a major area of discussion in sociology (Gibson et al., 1998). With the publication of Charles Tilly's book in 1984, *Big Structures, Large Processes, Huge Comparisons*, however, the issue of scale has been placed squarely on sociologists' agendas (ibid.). Tilly criticises many aspects of traditional sociological theories because they address social processes in abstraction, without specifying temporal or spatial limits. Tilly's method is to specify the scale of analysis first and then to find fundamental processes and structures within that scale. Coleman (1990) has another scale-related critique of the sociologists. He directly addresses the problem of the lack of analysis of multi-scale social systems in sociology. He critiques sociologists, amongst them Weber, for using macro-phenomena to explain other macro-phenomena at the same scale and ignoring lower-scale phenomena. By doing this, he says, they omit examining how lower-level phenomena react to macro-level phenomena.

Scales in policy sciences
As in other sciences, scales divide policy sciences into different sub-disciplines in order to analyse political systems, institutions and political behaviour. Many policy scientists focus on actions and outcomes of aggregated units of government at different geographical scales: local, regional, national, and international (Gibson et al., 1998). Political/ administrative spatial scales are set by the area of control, the influence or access rights exerted by a particular level of social organisation. In water management in the Netherlands, characteristic institutional scales that can be distinguished are the national government (the Ministry of Water Management and Transport), the regional governments (the provinces and the water boards), and the local governments (the municipalities).

Scales in economics
Economics has embraced the concept of scale in the study of allocation of scarce resources by developing two distinct theories: a micro-analytic and a macro-analytic theory. Micro-theories focus on small-scale processes such as incentives faced by producers, distributors and consumers as they are embedded in different market structures. No distinction is made between individual behaviour and the behaviour of an organised entity (for example, a firm of thousands of employees; Gibson et al., 1998). Macro-economists study large-scale economic phenomena, varying from how global economic trends affect countries (Evans et al., 2003) to economic scenarios for the industry in Europe or a specific country. Macro-economic scales are often related to political/ administrative scales, and are determined by the area over which goods or services are traded, extracted or disposed of (Scholes et al., 2002). It should be noted that there is no explicit reference to space. Few economists have made an attempt to link the macro- and micro-scales in economy (Evans, et al., 2003). One of the exceptions is Partha Dasgupta (1997) who was concerned with the problem of linking different scales. When economists study short periods of time, they simplify their analyses by taking slow-moving variables as exogenous and focus on the fast-moving variables. This has been a successful strategy, but Dasgupta points to the repeated findings in ecology that it is the interface between fast- and slow-moving variables that produces many important phenomena.

Scales in spatial planning
In spatial planning, scales are regularly used that have a clear spatial relation such as a region, community and neighbourhood. Otter (2000) distinguishes a micro- and a macro-scale in spatial development, noticing that many actors on a micro-scale make decisions that cause patterns on a macro-scale. These patterns can be largely explained by studying the interactions on a micro-scale. She concludes that the interactions on a micro-scale are of crucial importance to spatial planning.

3.5.4. Scale choices in integrated water management research

Scale choices in disciplinary research are often trivial because the disciplines have characteristic scales that they use for analysis, matching with the system scale. In interdisciplinary studies, scale choices are no longer trivial because different disciplines have different views, so often scales will not match. This is illustrated in Table 3.3 in which an overview is given of views on scales from different disciplines involved in integrated water management. Spatial boundaries are central to integrated water management because they specify the area over which jurisdictions apply, as well as the roles that particular actors are assigned (Murphree, 2000). Specifying jurisdictional zones is, nevertheless, easier said than done, not least because administrative boundaries, infrastructural links, and informal networks seldom correspond with the water boundaries, to the extent that these can be agreed upon (see also Section 1.4).

With the growing need for interdisciplinary approaches towards problems, such as in integrated water management, there is also a growing need to address scale choices adequately and consistently (Jewitt, 1998). Therefore, within integrated water management, scale choices form a challenging area of concern because many different disciplinary views on scale need to be integrated somehow. The question of the appropriate scale for the integration of models from different disciplines is a problematic one and has been formulated by Loucks et al. (1985, p.100) as: "How can one most efficiently link predictive models from various disciplines when these may operate on different and varying spatial and temporal dimensions?"

Linking information of different scales is usually a difficult challenge and sometimes leads to comparing apples and oranges. A careful approach is therefore needed. It all starts, however, with insight into ways of thinking about different disciplines and in understanding the different disciplinary views about scale.

Table 3.3: Different disciplinary views on scale

Discipline	**Key issues**	**Characteristic spatial scale**	**Characteristic time scale**	**Units of analysis**	**References for scale-related issues**
Sciences related to the physical system					
Hydrology	Groundwater flow, Surface water flow, Water quality	Groundwater: 1 m2- 100 km2 (volume) Surface water: 10 m-10.000 km	Groundwater: Days-50 years Surface water: Minutes - 1 year	River basin, river, reach, aquifer	Blöschl and Sivapalan (1995) Feddes (1995) Sposito (1998) Schulze (2000)
Morphology	Sediment movements	1 m^2 – hundreds of km2	25-100 years	Multiple-channel systems, river bed, sediment layer, morphological unit	De Vriend (1999)
Ecology	Sustainability of species, Preservation of ecosystems, Biodiversity	1 m^2 –millions km2	Long term (important features: biodiversity) Time scale increases with the spatial scale	Biosphere, ecosystem, community, species, population, organism	Levin (1992), Holling (2001), Hauffler (1999)
Geography	Explanation of spatial patterns	Several km2- millions km2	diverse	Very diverse	Montello (2001), Meentemeyer and Box (1987)

Meteorology	Climate change, Weather forecast	Global regional	Decades, centuries (climate change) years (rainfall) days (weather)	Continental systems, regional systems	Clark (1987)
Sciences related to the human system					
Economics	Costs and benefits, demand and supply	Non-applicable	Relatively short term (1-10 years)	Macro: (state, federation) and micro: (organised entities, like firms)	Dasgupta (1997) Schumacher (1973)
Sociology	Social interactions	Non-applicable	Non-applicable	Groups, individuals	Tilly (1984), Gibson et al. (1998), Ostrom
Policy sciences	Government, institutions, politics	Diverse	Relatively short term (1-10 years)	Governments at national/ regional/ local scale	Veen and Otter (2003)
Spatial Planning	NIMBY, building areas, integration of sectors	Variable, coordination exists between scales	20 years (buildings) 20-100 years (roads)	Region, city, neighbourhood	Otter (2000), de Jong (1996)

3.6. Scale according to the political rationality

3.6.1. Decision making scale

A key issue in the political rationality is the decision making scale. The decision making scale is generally accepted to be the scale at which policy makers address their questions and focus their actions (Jewitt, 2000). Often the decision making scale coincides with the institutional scale of the commissioners of the study because they want to start a policy analysis process, for example to design a new policy. The choices of decision making scale for integrated water management can be made from a large continuum of options (Murphree, 2000). Especially the spatial boundary setting plays a prominent role in the decision making scale. Spatial boundaries are central to integrated water management because they specify the area over which jurisdictions apply, as well as the roles that particular actors are assigned (Murphree 2000). Specifying jurisdictional zones is, nevertheless, easier said than done, not least because administrative boundaries, infrastructural links, and informal networks seldom correspond with the water boundaries, to the extent that these can be agreed upon.

In the selection of the decision making scale multiple dilemmas play a role, amongst which the *Big government* versus the *Small is beautiful* that was explained in Section 3.3. A small management scale is transparent and more politically acceptable, controls are tighter and more efficient. A large management scale takes into account the interconnectedness, making it possible to manage the interrelationships (Murphree, 2000). The decision making scale has a close relation to the system scale. When a problem manifests itself at a large spatial physical scale it can better not be managed by a small institutional organisation because the coverage regarding measures is too small. When a problem manifests itself at a small spatial physical scale the problem can probably be handled more efficiently by a local institutional organisation because large institutional organisations have insufficient knowledge of the local situation, is too inefficient and the distance to the local people is too large lacking carrying capacity.

According to the National Research Council (1999) the following questions need to be addressed in the selection of the appropriate decision making scale:
1) What scale is optimal for solving the problem identified?
2) Can decision makers effectively influence critical areas, given the scale selected?
3) Is the scale selected large enough so that the problem and its solution can be effectively evaluated?
4) Is decision making at the selected scale politically feasible and economically affordable? (National Research Council, 1999)

An important point to note is that the decision making scale is not selected within the policy analysis process but in the policy context already before the policy analysis process starts and is therefore regarded as an exogeneous factor in the policy analysis process.

3.6.2. Strategic behaviour related to scale

The consideration of scale is important to the analysis of many problems because scale can also be used in a strategic way, as was already noted in Chapter 1. In policy analysis processes, actors with different (or even conflicting) interests towards different scales may be involved. Different points of view can be chosen in the selection of scale. For each selection, sound arguments from that point of view can be made. As stated before, the adoption of a particular scale in a policy analysis process sets boundaries on the types of problems that can be addressed, the options found and the impacts to be addressed. The selection of scale has to be made in a very careful way because scale is *not politically neutral*. Scale has a strategic value because the selection of scale may intentionally or unintentionally privilege certain stakeholders (Sarukhán and Whyte, 2003). For example, an actor can be privileged if the problem he perceives is central on the selected scale.

Up until now, the attention given in the literature to multi-stakeholder views on scale choices has been rather limited. Also, the strategic handling of scale choices is not often discussed. In this section, first, the available literature is reviewed. Next, some plausible methods of strategic handling of scale are provided based on logical arguments to make the political rationality a little more specific. Also, some practical examples are given.

Political geographers have used diverse situations to document how different actors constrain, create and shift scales and levels to serve their own interests (Cash et al., 2006; Swyngedouw, 1997). Actors can change their power and authority by working at different spatial scales (Lebel et al., 2005). Scale choices can be a means of inclusion or exclusion, not only regarding the content of the study but also for the actors involved who depend on the scale that is selected; new actors may enter the process while other actors may exit the process.

When a different scale is used, the position of the actors in the process can be different (Vreugdenhil, 2005). It is very important to understand the role that actors play and how this influences the process. Vreugdenhil illustrates how scale is influenced by the actors' roles by using a case on floodplain management. She shows that actors may become more or less dedicated and more or less critical when a different scale is selected. A dedicated actor has an interest in the problem and wants to participate actively in the process to solve it while a non-dedicated actor does not have an interest in the problem and stays at a distance (De Bruijn and ten Heuvelhof, 1999). A critical actor has the power to obstruct the process or the power to make the process succeed; a non-critical actor does not possess the means to do this and can therefore be more easily ignored (ibid.). By changing the scale, a non-dedicated actor may become dedicated or more critical, and the other way around. Vreugdenhil (2005) shows that by scaling-up a problem the number of critical and dedicated actors may increase because more actors are affected.

Environmental assessments are especially subject to biases arising from choices of scales (Lebel, 2005). João (2007) speaks about environmental impact assessment regarding scale abuse and defines it as the choice of scale that leads to the preferred answer rather than the solving of the problem. Ross (1998) notes, for example, the possibility that results can be manipulated according to the size of the area studied in relation to cumulative effects assessment: "The greater the area assessed, the smaller will be the percentage of impacts caused by the project, because more other sources of impact get captured in the analysis. While I would not suggest this happens on purpose (a proponent wishing to have it appear that a project causes only a small portion of the impact), it is an interesting feature"(p. 271). In policy analysis, it is more difficult to speak of abuse because it is always a matter of perspective, interest and value, but using scale choices strategically is certainly possible. Interests do not always fit neatly in the hierarchical ordering, described in the previous section from small to large, because interests are not always closely aligned with particular scales (Lebel, 2005).

A close link exists between multi-stakeholder views and the strategic goals of policy analysis as addressed in Section 2.5.3. Some of these strategic goals can be supported by making clever scale choices. For example, if actors want to delay a study, it may be helpful to select a large scale with a low level of aggregation. Policy analysts need to be aware of the fact that scale can be used as a strategic instrument by actors involved in policy analysis to get what they want. Also, the other actors in the process have a responsibility in this matter and analysts need to be alert to other actors using scale choices in a strategic way. Some examples of the strategic handling of scale are given in Boxes 3.1 and 3.2. Looking from the perspective of the national government, the example in Box 3.1 shows a method of strategical behaviour that may be valued negatively, while the example in Box 3.2 shows a method of strategic handling of scale by regional governments that may be valued positively.

Box 3.1: Limit the spatial boundaries to avoid legal requirements
For large projects, often environmental impact assessments need to be done. This can also be a motivation to split the project up into smaller parts, in which case no EIA needs to be done. An example of this can be seen in dike reconstruction projects in the Netherlands. An EIA needs to be done in dike reconstruction projects larger than 5 kilometres. Therefore, a lot of projects exist that are a little smaller than 5 kilometres (Pers. Com., Anonymous, 2004).

Box 3.2: Think long term now to avoid discussions later
In the Netherlands, a paradigm shift can be noticed from protection against flooding to giving more space to the rivers. In this program, the national government focused mainly on the middle long term (2015). The regional governments, however, preferred to include the long term (2050) in the discussion as well because of the large impact of the Space for the Rivers program on the regions. The program has an especially large impact on spatial planning near the rivers, for example the location of new housing areas. The regional governments do not like uncertainty about this issue and avoid the risk of having to go through the entire discussion again in a few years time about additional measures (Pers. Com., Anonymous, 2005).

3.6.3. Process related chances offered by scale

Besides the possibilities of strategical behaviour, scale may also offer chances for the process that can be exploited for example by policy analysts. Especially in sensitive situations in which conflicting interests are present the selection of scale may contribute to the progress (Karstens, 2004). A wide time scale for example makes it much easier to reach consensus than when the focus is put on urgent short-term issues. If a scale is selected that excludes actors with conflicting interests although this may not be good for the progress on the long-term. Also a high level of aggregation might help because the devil is often in the details and the details can be worked out later. Also, by looking at a larger spatial scale it is possible to create more solution space in case of a deadlock (Meijer, 2007), see Box 3.3. Scale may also be used to remove the sting out of a conflict. For example, it may be possible that actors who are in conflict with each other on a small scale share interests when looking at a larger scale. When looking at it from a more aggregated position, the significance of who wins and who loses may disappear as well. Another possibility exists when by upscaling an actor that may influence the problem in a positive way gets involved.

Box 3.3. Options to secure drinking water supply
A drinking water company in Utrecht had to define measures to be able to maintain their water supply for the future. First, all the alternatives falling within the jurisdictional area of the drinking water company were studied, like the use of basins, river bank water and depth infiltration. Not one of these alternatives appeared to be satisfying. Finally, the system boundaries were enlarged and a feasible solution - buying water from another drinking water company - was found just outside the jurisdictional boundaries in the province of Flevoland. So, it helped to get the province of Flevoland involved (Meijer, 2007).

3.7. Scale according to the managerial rationality

From a managerial rationality, the achievement of objectives within time/ budget constraints plays an important role, as was concluded in Section 2.4.5. In a managerial rationality, the question needs to be answered about how scale choices influence the achievement of objectives within these constraints.

From a scientific rationality, processes should ideally be observed over a large extent and with a high resolution and low level of aggregation in order to allow a signal within the process to have been observed at the appropriate scale (Schulze, 2000). This is, however, rare due to practical constraints and available time and budget. It is expensive and time-consuming to work with large-scale high-resolution models with their large appetite for data, which is often unavailable (Davis and Bigelow, 1998). Another reason for large scale and high resolution to come with a cost is the complexity of the models, making them harder to program, debug and validate (Davis and Bigelow, 1998).

From a managerial rationality point of view, especially the combination of temporal/ spatial boundaries and the level of aggregation plays an important role. In order to be able to finish a study on time and within budget, a balance is needed between extent and detail. The selection of extent and level of aggregation are strongly interrelated. Studies that combine large boundaries with a low level of aggregation usually require a lot of time and a big budget.

Therefore, if time and budget constraints play an important role, often a trade-off has to be made. A large extent is commonly used in combination with a high level of aggregation. In small extent studies, usually a more detailed approach is used. A graphical view of the relationship between extent and detail as perceived by João (2002) is given in Figure 3.7.

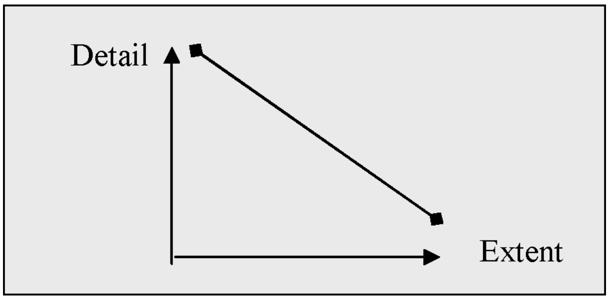


Figure 3.7: Graphical view of the relationship between extent and detail (from João, 2002)

Practice shows that the overall boundaries of investigation may often be less affected by funding, but the level of aggregation will still be (João, 2007). If budget and time allow, studies are done with more detail or for larger spatial extents, but often limited budgets can be an important constraint for scale choices. The often delicate balance between the level of aggregation, the spatial boundaries and the dilemmas involved are mentioned quite regularly in the literature, not only in policy analysis but also in Environmental Impact Assessment.
"If large boundaries are defined, only superficial assessment may be possible and uncertainty will increase. If the boundaries are small, a more detailed examination may be feasible but an understanding of the broad context may be sacrificed. Proponents may perceive assessments with large boundaries as onerous or unfeasible, whereas the public may think small boundaries do not adequately encompass all of the project's environmental effects" (Canadian Environmental Assessment Agency, 1996, p. 13).

3.8. Scale according to the design rationality

3.8.1. Introduction

To be able to make the concept of scale more specific and usable in the design rationality, it is helpful to recognise the presence of different types of scale choices that need to be made when designing a policy analysis process. Therefore, in Section 3.4 a distinction was made between the observation scale, the analysis scale and the presentation scale.

These types of scale choices have close relationships to each other and therefore cannot be selected independently from one another. In an ideal situation, one might say that these types of scale choices would match with the system scale in order to gain a proper understanding of the system being studied. In reality, this appears hardly ever to be the case because of practical objections like time/ budget limitations and data collection limitations. The relevant scale for a policy analysis process is not only dependent upon the spatial and temporal responses of the system being modelled but also on the planning or operational decisions to be made at each spatial increment (Jewitt, 1998). So, two scales (the system scale and the decision making scale) must play a role in the selection of the appropriate scale(s) for the analysis.

Although the types of scale choices cannot be selected independently from each other, they often do not match. For example, a mismatch often occurs between the modelling scale and the presentation scale because the information in the modelling process is much more detailed than the information that is needed for the presentation. In general, upscaling the results for the presentation may be needed.

It is important to be aware of these different types of scale choices in the spatial boundary setting, the temporal boundary setting and in the selection of the level of aggregation. In the following subsections, the different types of scale choices are addressed in greater depth. Also, the upscaling and downscaling issue will be addressed because they often play an important role in studies in general when the different types of scale do not match. For each type of scale choice, when possible, guidelines are given that may help to determine the appropriate scale. Also, the dilemmas and pitfalls that are related to the types of scale choices are mentioned. A dilemma is a tense relationship that exists between two alternatives that are difficult or impossible to unite (van Twist, 1998). A dilemma is always based on perceptions and values and is unavoidable. Table 3.4 presents a preview of the different types of scale choices including the related dilemmas and pitfalls. The concept of dilemmas plays an important role in this research and is therefore further explained in Chapter 4.

Table 3.4: Preview of types of scale choices, related dilemmas and pitfalls

Types of scale choices	Relevant questions that need to be addressed before making the choice	Examples of dilemmas	Examples of pitfalls
Observation scale	Is it possible to collect information at this scale?	Handle the practical and budget constraints related to sampling and modelling	Errors of omission and errors of commission
Analysis scale	What are the problems addressed, the options found and the effects assessed?	Study all relevant systems on their own appropriate scale and integrate later versus define one scale from the start	- Analysing only the scale that is most apparent - Neglecting the problem of fit
Presentation scale	Decision making scale is central: what information is really needed to be able to make a sound decision? How to connect to the discussion/ discours?	Being immersed in too much information (cannot see the forest for the trees) versus not presenting enough information to make a balanced decision	- Hiding or stressing negative or positive effects by certain political actors - Researchers present too many unnecessary details

3.8.2. Observation scale

The observation scale is the scale at which phenomena are observed (Blöschl and Sivapalan, 1995). Two types of activities can be distinguished through observation: sampling and modelling. Sampling involves the collection of data in the real world that is representative while models are abstractions of reality. The sampling scale can be defined as the scale for which the sampling provides an average value (Bierkens et al., 2000). The sampling scale can restrict the generality and utility of the findings (Lovell et al., 2002). The model scale is the scale for which the model provides its output (Bierkens et al., 2000). The sampling scale and the modelling scale need not be similar and often will not be similar. Often, the sampling is done in point measurements that need to be scaled up to a modelling block. Also, it may happen that downscaling is needed, for example when a rainfall-runoff model needs hourly rainfall data, while rainfall totals are available on a daily basis (ibid.).

In every sampling or modelling activity, a number of scale choices need to be made. With regard to the spatial and temporal scale, choices need to be made concerning the extent and the resolution:
Concerning the extent:

- The spatial boundaries (e.g. the jurisdictional boundaries of a country)
- The temporal boundaries (what time range is included? e.g. observations during a year)

Concerning the resolution/ level of aggregation:

- The spatial step (e.g. a grid of 100 by 100 metres or 10 kilometres by 10 kilometres)
- The time step (what time interval is included?; e.g. yearly, monthly, daily, per hour)

Many studies recognise that researchers should always strive to use the system scale as a starting point for the selection of the observation scale. The observation scale is therefore closely related to the research rationality. “Assessments need to be conducted within a scale domain appropriate to the process, phenomenom or system being examined” (Sarukhán and Whyte, 2003, p.107). Ideally, systems should be observed at the scale at which they manifest relevant changes in state (Blöschl and Sivapalan, 1995). However, this is not always possible, as many processes simultaneously operate at a variety of scales and often only small-scale (e.g. point) measurements are available or can be made (Jewitt, 1998). Also, these scales are usually imposed by perceptual capabilities, or by external factors like technological, logistical or financial constraints. For example, data collection possibilities are often limited because of practical or economic constraints. Therefore, in sampling, the required precision/ reliability versus the available budget/ time and practical constraints form an important dilemma. In those cases the managerial rationality plays an important role in the observation scale as well.

Observation at an inappropriate scale may lead to inappropriate explanations and relationships in different ways. Some examples are provided below.

- *a. System scale is larger than the observation scale→ Characteristic variety may be missed, trends are not noticed (white dots in Figure 3.7)*
  If, for example, an assessment covers a shorter time period than the characteristic temporal scale, it may not adequately capture the variability associated with long-term cycles, such as glaciation. Slow changes are often harder to measure, as is the case with the impact of climate change on the geographic distribution of species or populations. Moreover, both ecological and human systems have substantial inertia, and the impact of changes occurring today may not be seen for years or decades.

- *b. System scale is larger than the observation scale → falsely assuming there is a trend (black dots in Figure 3.8)*
  If the impact of processes are assessed at scales significantly smaller than their characteristic scale, then there is a very large danger of drawing a conclusion that is even more wrong than the previous pitfall described; the danger of assuming that there is a trend, based on a short duration time series of data drawn from a process with a long-term cycle, is well known (Scholes et al., 2002).

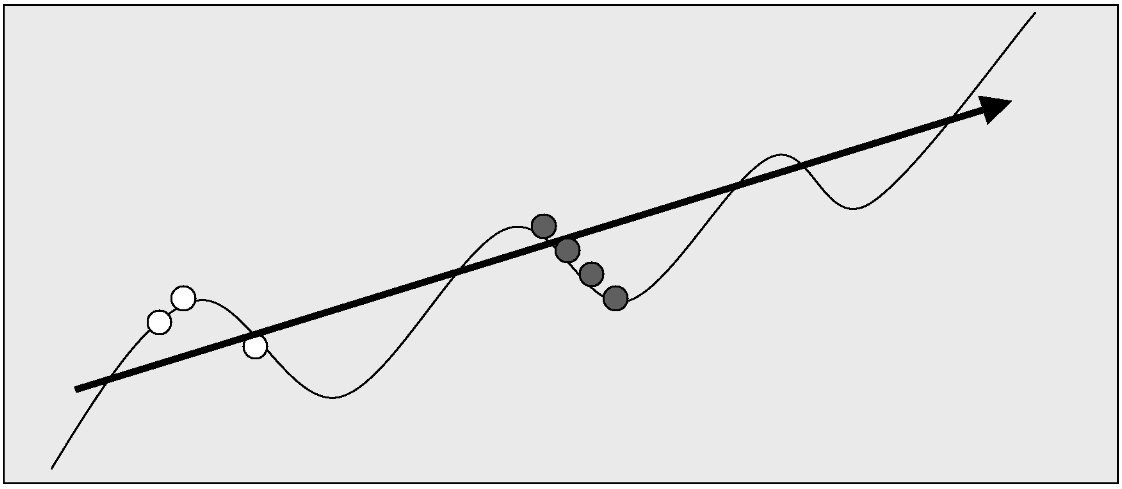


Figure 3.8: False assumptions caused by the selection of system scale that do not match the observation scales: In the white dots the ascending trend is missed in the limited observation time scale while the black dots indicate a descending trend occurring in the process, while the trend in reality is upward (ascending line).

- *c. Level of aggregation observation scale is higher than the characteristic variability of the system → characteristic variability may be missed (Figure 3.9)*
  There is also a danger in observing at too high a level of aggregation, since this may homogenise the important details and cause them to be missed.

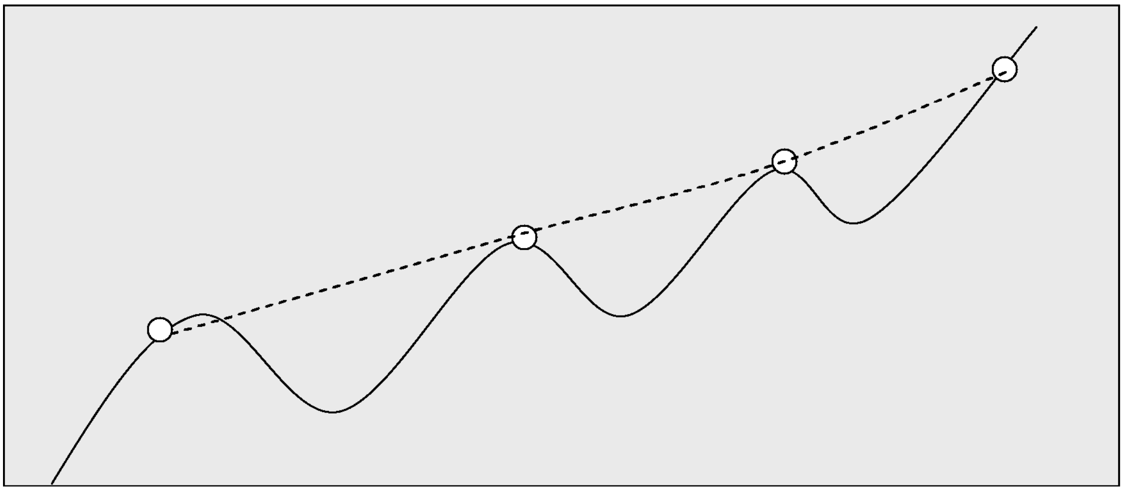


Figure 3.9: The variations may be characteristic, but are missed by the high level of aggregation (dashed line)

- *d. Level of aggregation observation scale is higher than the characteristic variability of the system → falsely assuming that there is a trend (Figure 3.10)*
  Another danger is related to the possibility that, by coincidence, measurements are taken that indicate an ascending trend that does not exist.

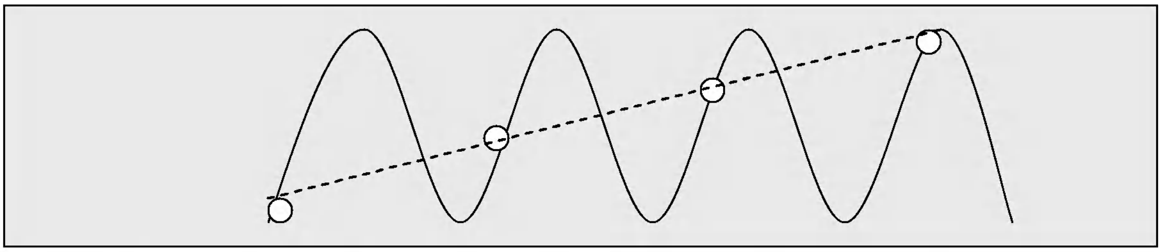


Figure 3.10: The variation may be seasonal but an ascending trend is falsely established

Haufler et al. (1999) address these pitfalls as errors of omission and errors of commission. In the case of an error of omission (pitfall a and c), the occurrence of a process fails to predict what is actually present, so a characteristic trend is missed. Errors of commission occur when a trend is erroneously predicted when it is actually absent (pitfalls b and d).

3.8.3. Analysis scale

The analysis scale is the scale at which the analysis of problems is conducted, the design of options is completed and the impacts are assessed. Some might think that observation and analysis are similar, but analysts know that the model does not do the analysis, but that it merely provides input for analysis (Davis and Bigelow, 1998). The analysis scale needs careful consideration for a number of reasons. Setting the analysis boundaries as a river basin, as opposed to a geo-political identity, may make good sense from an ecological systems perspective but may be irrelevant for management if there is no available institution at that scale or no political mechanism to deal with transboundary issues (Scholes, 2002). In interdisciplinary studies the dilemma is whether to study all relevant systems on their own appropriate scale and integrate later or define one scale from the start.

An important pitfall that is related to the analysis scale is that scale choices fall prey to lazy thinking - analysing only the scale that is most apparent or easiest to deal with (João, 2000). For example, having the scale of the jurisdiction of the commissioner of the study selected as the analysis scale. Sometimes, it may be helpful to extend the scales beyond the influence of the commissioner of the study because ‘better’ solutions for a problem may exist just outside the jurisdiction of the commissioner that may be feasible after negotiation with other parties. The examples from the literature in Box 3.4 illustrates this phenomenon of sub-optimisation and the related pitfall of assuming that the scope of analysis should coincide with the scope of the decision-making authority.

Box 3.4. Handling pollution problems

It seems ‘natural’ for an environmental agency working on a specific pollution problem to consider only alternatives falling under their own jurisdiction. “Even the competent analysts of the Delaware Estuary Comprehensive Study chose to confine their inquiry to the Delaware estuary for which they were directly responsible instead of considering other and probably better alternatives for outdoor recreation.” Majone and Quade (1980, p. 10)

Another pitfall is ignoring the problem of fit between the institutional scale of the commissioner of the study or the actors involved and the analysis scale. Although it was illustrated above that sometimes it may be functional to look a little beyond the institutional boundaries of the commissioner, it is important to take these boundaries into consideration to be able to come up with solutions that can be implemented by the commissioner of the study.

Policy analysts need to review the scale choices critically and try to find a delicate balance by taking both the problem of fit and the advantages of extending the solution space beyond the jurisdictional boundaries of the commissioner of the study into account.

Analysis scale of problem assessment
In the scoping phase (see Figure 2.1), the problem to be analysed is defined. The analyst may opt for a focused problem analysis by choosing narrow system boundaries, or for a comprehensive problem analysis by choosing broad system boundaries. An important question that plays a role is: At what scale does the problem manifest itself? That scope can vary widely and has great consequences for the analysis and illustrated in Box 3.6 in the case of the water shortage in a large river basin. Changing the analysis scale has significant consequences for the problems to be analysed. Differences in scale choices will lead to differences in the design of the studies, the models that are used, the results they generate, and the influence they have on the decision-making processes (see Box 3.5).

Box 3.5: Different problems at different scales in water shortage
On the *basin scale*, the problem is how to distribute (as far as physically possible) scarce water resources among nations. On a *national scale*, the question is how water resources can best be allocated to regions within the nation, taking into account that some regional functions, such as electricity production and shipping, may be vital to the national economy. On a *regional scale*, the direct impact of water shortage is felt by farmers, for example, and trade-offs have to be made in keeping with the interests of local stakeholders. Choices made in the scoping phase will determine whether the problems that become manifest at different scales are addressed in a single, comprehensive analysis, or in a range of studies that focus on a selection of specific issues and different scales.

By enlarging the system boundaries of a problem, variables that were first external to the problem (exogeneous factor) may become internal. This is illustrated in Figures 3.11a and 3.11b. For example, the exogeneous factor *upstream pollution by industry* may become an internal variable that can be influenced if the system boundaries are enlarged in such a way that these industries fall geographically within the system boundaries.

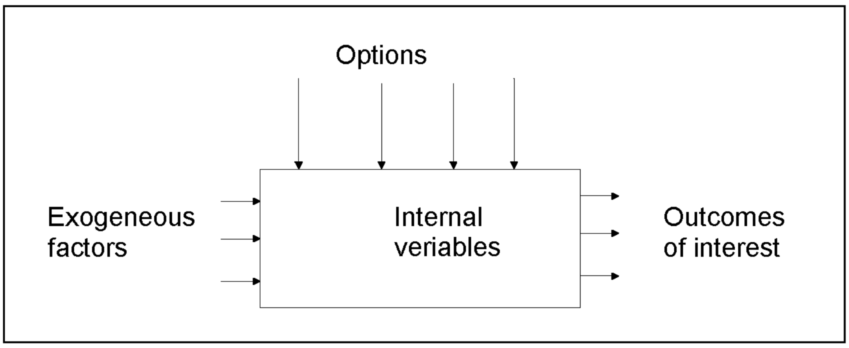


Figure 3.11a: System diagram system X

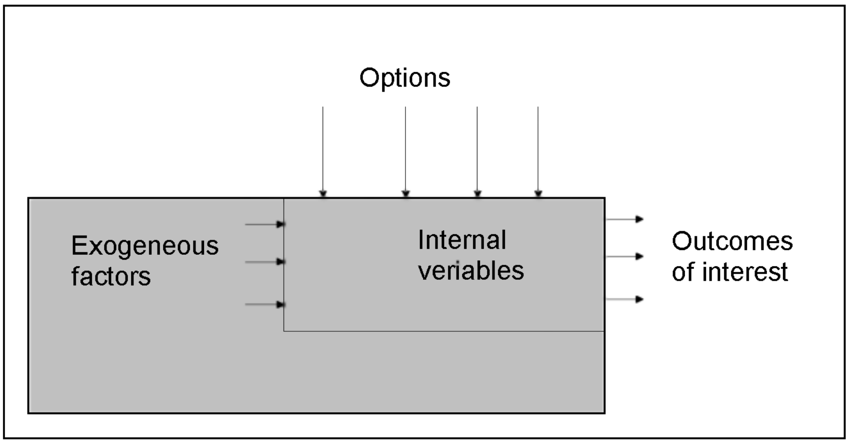


Figure 3.11b: Possible consequences of upscaling: exogeneous factors may become internal variables

Analysis scale of design of options

Once the problem has been defined in the scoping phase, scale choices in the design phase may set additional limits on the solutions to be considered. An example of a question that may arise is: At which scale the problem can be solved most efficiently? This can be illustrated using the case of mitigating the risk of flooding by the river Rhine in the Netherlands, as shown in Box 3.6.

Box 3.6: Balancing efficiency and effectiveness in the prevention of floods

Institutional boundaries versus physical systems boundaries

Even if the analysts focus only on the problem of high river tides and on ways to keep the dikes from breaking, they still can make choices regarding spatial and temporal scales.

Flooding problems can be solved at an international or a national scale. When looking at the Rhine flooding problems in the Netherlands, taking into account solution directions limited to the

Netherlands may lead to ignoring potential, and maybe more effective, solutions in Germany. This limited-scale selection has the advantage that the possibilities of implementing measures are within the authority of the Dutch government, but the measures themselves might be less effective. Looking for solutions in an international context, on the other hand, may take considerably longer and may end up with agreements that are poorly enforced.

Short-term versus long-term solutions

If the problem needs to be resolved in the short term, for example in the case of large risks for calamities, solutions will be used with a short-term impact, such as dike improvement. In that case long-term solutions do not provide an answer. If the problem of high river tides is studied on the long term, also other alternatives such as calamity polders and giving more space to the rivers may be promising. Although in the long term more solutions become feasible, also more uncertainties play a role. Therefore, it is more difficult to make decisions, which may cause limits to the action's success.

Changing the analysis scale also can have great implications for the options to be found. By upscaling, the solution space may become bigger as was illustrated in Boxes 3.4 and 3.5. Figures 3.12a and 3.12b schematically show the consequences of upscaling for the design of options.

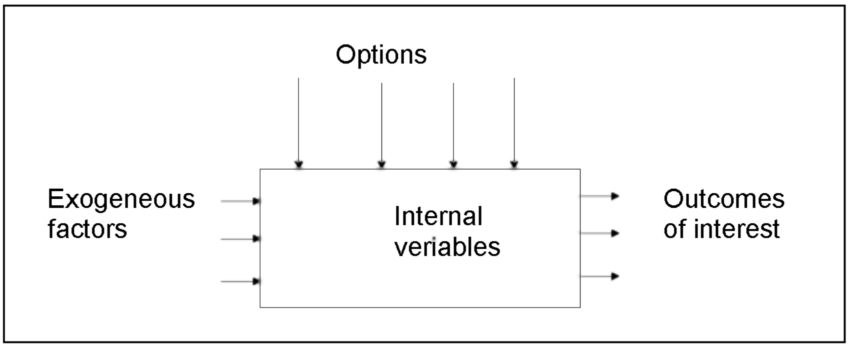


Figure 3.12a: Initial system diagram

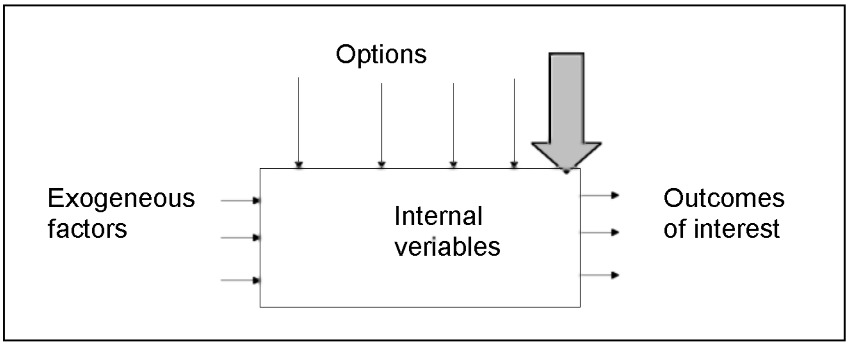


Figure 3.12b: Possible consequences of upscaling for the options: additional options may become available (big grey arrow)

Analysis scale of impact assessment

João (2000) notes that scale choices may have an effect on the type of impacts found, their magnitude and significance. A major challenge for impact assessment is to clarify the interdependencies among impacts on different scales, and to produce relevant information on a scale that is appropriate for different stakeholders involved in the different sectors. The analysis scale of an impact assessment needs careful, separate definition because the impact of an option may extend (far) beyond the immediate study boundaries, and effects of small-scale solutions can have consequences on a much larger scale. This is illustrated in Box 3.7 with the case of the construction of a medium-sized hydrodam. Also, the selection of the level of aggregation needs careful attention because of the distribution of effects as was shown in Box 1.4.

Box 3.7: Effects exceed the project boundaries in dam planning

Assuming that in the scoping phase hydropower was seen as an efficient and sustainable solution to meet a city's growing demand for electricity, it is likely that when developing and evaluating different dam designs the focus will be on the power generated, plant operability, safety and, of course, cost. It is unlikely that, at this stage, engineers will take note of the growing evidence that decomposition of the forests under water in the dam's reservoir produces more greenhouse gas than a coal-firing plant. Likewise, the impact of a dam on a larger scale, such as the collateral social damage (displacement of population), health risks (malaria) and ecological damage (loss of habitat), may be ignored since they do not discriminate between different dam designs. But, a full-fledged environmental impact assessment might reveal that the local and regional benefits of a dam (electricity, irrigation) are lost to the system overall.

3.8.4. Presentation scale

The scale at which the information and the results of a policy analysis process are presented to the actors involved during and at the end of the process is called the presentation scale. Always, a match has to be found between the message to be told and the audience of the presentation, so the decision making scale has to be taken into account in the presentation scale. Especially the choice of the level of aggregation plays a prominent role in this scale. A common step to be taken is to aggregate findings in order to make them presentable. The selection of the level of aggregation is very much affected by the goal that needs to be achieved. In some cases it can be functional to show the details, and in other cases it can be functional to show the aggregated result. It is important to try to achieve a balance between not being immersed in too much information and not presenting enough information to be able to make a sound decision. Too much detail can render the information useless and meaningless because it is impossible to see the woods for the trees (Therivel, 2004). For researchers, this is often a challenge because they often have the habit of providing too many unnecessary details (for a general audience). Data availability, however, must play a minor role in the determination of the presentation scale compared to what is needed for decision making.

When aggregating, information always gets lost. This fact may also be used strategically to hide or stress findings. It is therefore important to realise that the presentation scale is very politically sensitive. The scale at which the impacts are presented may hide or stress positive or negative effects (as shown in Sections 1.2 and 3.4).

Box 3.8 provides an example in which the difference between an aggregated presentation and a detailed presentation is shown.

Box 3.8: Different levels of aggregation serve different purposes in a water exploration map

In the southwestern part of the Netherlands, water exploration maps were created to show possibilities for and threats to water management. The assignment to make a map that explains the water system in a nutshell was given to an engineering firm and a landscape designer. Figure 3.13 shows the two resulting images. The map on the left exposes a high level of detail in which several layers of the GIS-database are visible. Every pump station is apparent on the map. The map on the right shows no detail at all. However, the right-hand picture shows the coherence of the related parts of the water system: the canals are drawn with different thicknesses to differentiate their importance and the height level of the area is divided into relatively high and low polder land (gray and white). It depends on the objective as to which map is most suitable. Both maps have their advantages and disadvantages. The left-hand map provides more information, but the large number of details might distract attention from the important conclusions. The right-hand map results in a better general understanding, but the question is whether some essential information has been left out. Also, the different maps cause different discussions: the left map generates discussion on the details, like the position of the pump stations, while the right map generates discussion on the bigger concept: how does the water circulate in the area? (Carton, 2007).

Figure 3.13: Explanation map that describes the water system by two different offices resulting from the same assignment. Left: map result from the GIS-database. Right: map result drawn by a landscape designer (from Carton, 2007).

3.8.5. Upscaling and downscaling

If large differences appear to exist between the observation scale, the analysis scale, and the presentation scale, upscaling or downscaling may be needed to translate information from a sampling scale to a modelling scale or from an analysis scale to a decision making scale. An example of upscaling is given in Box 3.9.

Box 3.9: Upscaling of data and models to answer the policy question

Is the norm of the European Union on nitrate leaching being met and, if not, what maximum amounts of fertilizer use will be allowed to meet this norm in the future? The concentration of nitrate in the groundwater is observed at a number of locations and depths on a parcel. With a model, the average leaching of nitrate from this parcel can be calculated, while the government requires figures on average leaching per region (from Bierkens et al., 2000).

Upscaling results from models to a larger decision making scale is most common but downscaling information from the model in order to answer a policy question may also occur occasionally (Bierkens et al., 2000). An example of downscaling is given in Box 3.10.

Box 3.10: Downscaling of models to answer the policy question

With global, environmental change models, the expected temperature changes over the next 50 years may be predicted on a global scale. A water board might be interested in what these temperature changes imply for the amount of precipitation that is expected in their area in order to predict water shortage situations (from Bierkens et al., 2000).

Upscaling and downscaling activities need to be undertaken with great care. Applying the same laws, regularities and relationships when moving from the observation scale to the analysis scale affects the conclusion because processes and parameters important at one scale may not be important or predictive at another (João, 2000). Many studies have illustrated this difficulty and address this challenge by providing guidelines and methods for upscaling and downscaling (Blöschl and Sivapalan, 1995; Bierkens et al., 2000).

3.9. Overview of scale choices and views on scale choices

In this chapter the concept of scale choices was made more specific and an overview of how scale is looked upon from different rationalities was provided.

In this chapter it became clear that the distinctions across three scale choices are, in reality, much more complicated. The selection of the level of aggregation consists of two separate choices: the spatial and the temporal level of aggregation. Also, the scale choices need to be made more specific to be able to work with them. Actually, three different scale choices need to be made when setting the spatial boundaries: the observation scale, the analysis scale and the presentation scale. The system scale is not an actual choice but depends on the disciplinary view that is taken into account. An overview is presented in Table 3.5 and shows that, in total, 12 scale choices need to be made in a policy analysis process.

Table 3.5: Typology of scale choices

General scale choices→ ***Specific types of scale choices***	**Spatial boundary setting**	**Temporal boundary setting**	**Selection of spatial level of aggregation**	**Selection of temporal level of aggregation**
Observation scale	1	4	7	10
Analysis scale	2	5	8	11
Presentation scale	3	6	9	12

The distinction between the system scale, analysis scale, observation scale and presentation scale can help to make scale choices more specific. Inquiry has revealed that scale choices are regarded as a rather vague subject by many people. Making a distinction between different types of scale in policy analysis processes can be helpful to provide clarity in the communication about scale choices. Table 3.6 gives an overview of the different types of scales, the relevant questions involved and the related dilemmas and pitfalls.

Table 3.7 shows two types of scale that influence the policy analysis process and therefore have to be taken into account but are not to be decided by the policy analyst. A dilemma that is related to these two scales is the handling of the mismatch between the physical system scale and the decision making scale (see also Section 3.3).

Table 3.6: Overview of specific types of scale choices

Scale choice	Relevant questions that need to be addressed	Dilemmas/ aims	Pitfalls
Analysis scale	What are the problems addressed, the options found and the effects assessed?	Study all relevant systems on their own appropriate scale and integrate later or define one scale from the start	Analysing only the scale that is most apparent, neglecting the problem of fit
Observation scale	Is it possible and feasible to collect information at this scale?	Handling the practical constraints related to sampling and modelling and budget	Errors of omission and errors of commission
Presentation scale	Decision making is central: what information is really needed to be able to make a sound decision?	Achieve finely tuned balance between not being immersed in too much information (cannot see the woods for the trees) and over-generalisation/ not presenting enough information to provide transparency and make a balanced decision	Hiding or stressing negative or positive effects by certain political actors; Researchers presenting too many unnecessary details

Table 3.7: Scales that influence the policy analysis process

Type of scale	Characteristic	Relevant questions that need to be addressed
System scale	Determination based on the choice of what processes are relevant	What types of processes are relevant? At what scale do these processes play a role?
Decision making scale	Scale at which policy makers address their questions and focus their actions. Often the decision making scale coincides with the institutional scale of the commissioners	What scale is optimal for solving the problem identified? Can decision makers effectively influence critical areas, given the scale selected? Is the scale selected large enough so that the problem and its solution can be effectively evaluated? Is decision making at the selected scale politically feasible and economically affordable?

Because of the different multi-disciplinary views and the multi-stakeholder views, no ideal scale seems to exist. Also, the available time and budget put constraints on the selection of scale. An extra complicating factor is that a mismatch often occurs in types of scale choices. Table 3.8 summarises the crucial characteristics according to each rationality.

Table 3.8: Views on scale choices and scale related characteristics according to the different rationalities

Rationality	View on scale choices	Characteristics
Scientific	Scale as a system related characteristic	Multi-disciplinary views on scale
Political	Scale as a social construct; an instrument to get what you want	Multi-stakeholder views on scale
Managerial	Scale as a scoping instrument limited by boundary conditions	Limited time and budget impose constraints on scale choices
Design	Scale as design decisions in a study	Scale discrepancy between sampling/ modelling/ observations and policy question (required presentation scale)

Summarising, the previous sections show four scale-related challenges that can exist in policy analysis processes that can also be derived from Figure 3.13 and are explained below:

1. *Dealing with multi-disciplinary views on scale*
   (Related to the scientific rationality; see Section 3.4)
   How to deal with different disciplinary views and how to link data and models from different disciplines?

2. *Dealing with multi-stakeholder views on scale*
   (Related to the political rationality; see Section 3.5)
   How to handle the multi-stakeholder interests in such a way that the objectives of the policy analysis process are achieved?

3. *Making scale choices in such a way that they contribute to the achievement of objectives within the boundary conditions*
   (Related to the managerial rationality; see Section 3.6)
   Scale choices have to be made in such a way that the objectives of the study are achieved while taking into account the time and budget limitations.

4. *Handling scale discrepancies*
   (Related to the design rationality; see Section 3.7)
   Often, large differences appear to exist between the scale of the available data, model analysis, and the scale of the policy questions that is closely related to the required presentation scale. In those situations upscaling or downscaling may be needed to translate information to the requested scale.

The examples in the previous sections show that scale choices have an influence on the policy analysis process and, therefore, it can be expected that they also have an impact on the achievement of the objectives of the study. However, little is known about the specific effects of scale choices on the policy analysis process and its outcome. This complicates rational design.

The presence of the multi-disciplinary and multi-stakeholder views, the limited possibilities related to the time and budget constraints and the difficulties in handling scale discrepancies raises, once again, the research question of this thesis: how are scale choices made when these different challenges exist?

4. Conceptual model and case study research approach

The real voyage of discovery consists not in seeking new landscapes
but in having new eyes.

-Marcel Proust

4.1. Preview of the chapter

The questions that were asked in Chapter 1 was how scale choices are made in policy analysis processes and what the effects of scale choices are. Chapters 2 and 3 offered an overview of the literature on policy analysis and scale choices. Different rationalities that play a role in policy analysis were identified: the scientific rationality, the political rationality, the design rationality and the managerial rationality. Chapter 3 explained how making a distinction between rationalities is also useful when looking at scale choices.

In this chapter, a conceptual model is developed that is used in the case studies to explore how scale choices are made in practice. The conceptual model serves as an observation framework (Yin, 1994) in the remainder of this thesis. In the conceptual model, the problem definition is further elaborated on and a distinction is made between the most important concepts that play a role in this research: the actors' views on scale alternatives, the process of making scale choices, and the effects that these scale choices have on the content, process and results of the study.

Next, the approach to case study research is discussed. Two cases are introduced, both of which are used to study how scale choices are made in real-world policy analysis processes. Also, the methods for data collection and data analysis are described.

4.2. Conceptual model

4.2.1. Introduction

The object of this study is *scale choices in a policy analysis process*. To gain better insight into the object of study, a conceptual model is constructed that is based on an input-process-outcome model. The input is defined as the actors' views on scale alternatives, alternative options for scale choices; the process is defined as the decision-making process resulting in a scale choice; and, the output is defined as the effects of the scale choices made.

In this research, a clear distinction is made between the initial design of a policy analysis process and the execution of that study. The dynamic character of the policy analysis process requires regular updating of the design. Therefore, adaptive design is often used. This also may result in adjustments in scale choices during the study. For this research, however, we make a clear cut between the initial design and execution of the study to be able to distinguish between the scale choices in the initial design and the effects of these scale choices on the execution of the study. Figure 4.1 shows the overall conceptual model. The actors' views, the decision-making process on scale choices and the effects of scale choices are the key issues under investigation in the case studies. These key issues are discussed in the following sections.

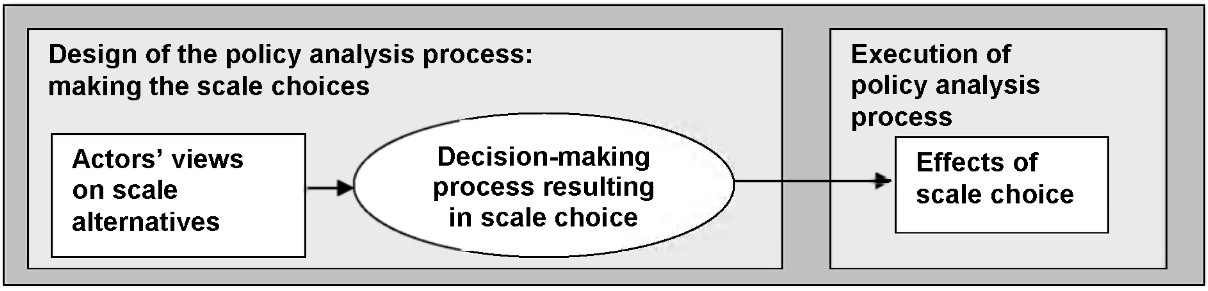


Figure 4.1: Conceptual structure for studying scale choices in policy analysis

4.2.2. Actor views on scale alternatives

In this research, the term 'actor' plays a major roleand can be used in different ways. Actors are people involved in the policy process and their choices ultimately define its outcome (Scharpf, 1997). They are characterised by their orientations (perceptions and preferences) and by their capabilities. Burns (1985, p. 9) defines actors as "persons, groups, organisations or networks that are capable of making decisions and acting in a more or less coordinated way". Burns and Scharpf both show that the actor concept comprises different levels. Scharpf makes a distinction between individual actors and corporate actors. "It is common and entirely legitimate practice to use aggregate categories for describing the parallel actions of populations of individuals who share certain characteristics such as the farm vote for a general group of farmers" (Scharpf, 1997, p. 56). This may sometimes cause confusion and, therefore, it is important to clearly define the level that is used. In this research, the term 'actor' denotes a corporate actor, a representative for an entire company or organisation.

In this research, Rhamatian and Hiatt's (1989) pragmatic/ behavioural framework of rationality of is adopted to identify how actors determine their preferences for scale. The basics of this framework have been explained in Section 2.5.1. This framework helps to find out what causal relations actors perceive exist between scale alternatives and the consequences of these scale choices. According to the pragmatic/ behavioural framework of rationality, actors consider the possible consequences of alternative scale options as depicted in Figure 4.2. This is often an implicit process. First, they determine the plausible scale alternatives. Then, they make a selective assessment of the expected effects, using only the criteria that they consider important. These criteria are assumed to be closely related to their objectives. Next, they evaluate the expected effects of the alternatives by comparing them with their own objectives. Finally, they determine which alternatives result in effects that match the actors' objectives best, the preferred alternative(s). The preferred alternatives in combination with the unacceptable alternatives and the non-preferred acceptable alternatives is called *the actor's view on scale alternatives*.

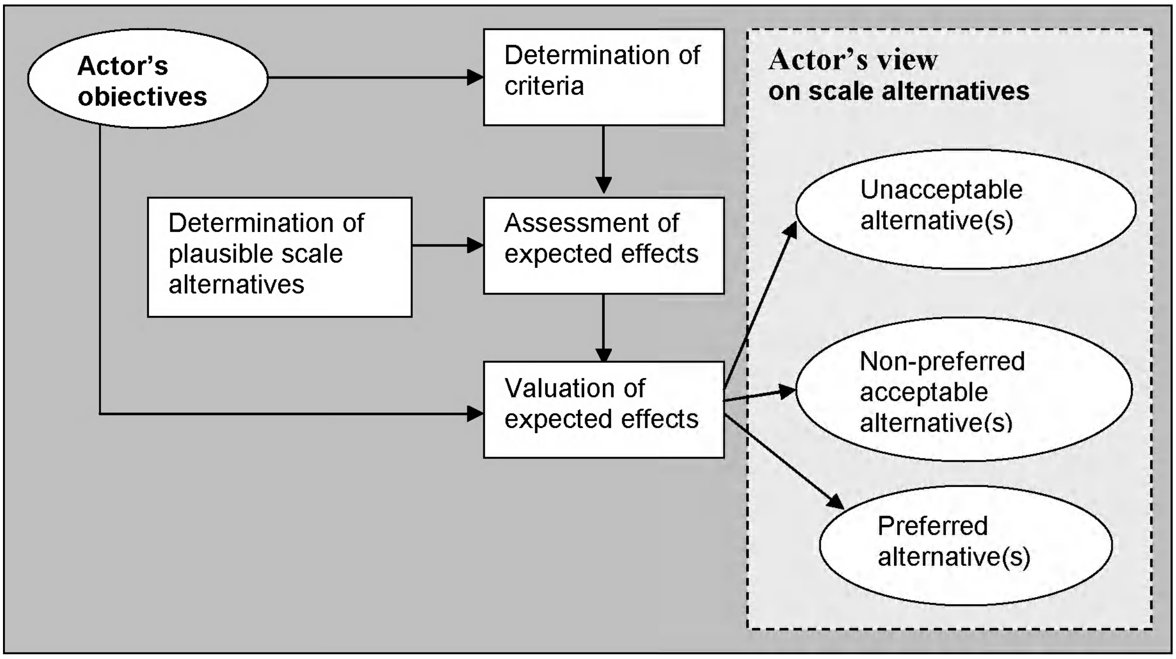


Figure 4.2: Actor's view on scale alternatives

When many actors are involved in a policy analysis process, it results in many views on scale alternatives that may all be different. The question comes up about how we can extract useful information out of all these different views and learn how scale choices are made. Can the number of actors distinguished in this research be reduced by creating a typology that does justice to the variety of actor views that exists in reality? This reduction in the number of actors is necessary because, otherwise, too many perspectives would need to be studied and this would result in too great a diversity in viewpoints to draw any conclusions. The rationalities as such are useful as an underlying concept, but not as an instrument for categorisation in practice because actors may have a combination of different rationalities, as will be shown later. So-called 'archetypical views' have been determined that are characterised by similar rationalities and perceptions on a policy analysis process. The typology of actor archetypes aims to provide a classification structure that gives insight into the views of these archetypes on scale choices. Also, it helps to understand their different ways of thinking. The typology is expected to be helpful to the policy analyst who tries to anticipate different actor views in new situations because it explains the tension field in which the policy analysts need to perform their study and helps to clarify the trade-offs that need to be made.

The literature was studied to identify the different types of actors that are involved in a policy analysis process. Goeller (1988) is one of the few authors who describes the diversity of actors involved in a policy analysis process. He makes a distinction between two kinds of parties of interest involved in such a study, one from the perspective of the problem situation and the other from the perspective of the analysis. Goeller suggests that a spectrum exists because no sharp boundaries can be drawn between the problem situation and the analysis. Along this problem situation-analysis spectrum, different roles can be identified that are more or less closely related to either the problem situation or the analysis. The actors related to the analysis and to the problem situation that Goeller distinguishes are listed in Table 4.1.

Table 4.1: List of actors' roles distinguished by Goeller (1988)

Actors related to the problem situation	Actors related to the analysis
Policy maker	Problem poser
Implementer	Sponsor
Operator	Client
Decision maker	Member of the staff
Responsibility taker	User
Staff member	Policy analysis team
Persons affected by the problem situation	Policy analysis peer group
Lobbyer	Research program director
Advisor	Advisor to the analysts
Evaluator	Formal reviewer
Enforcer	Implementation planner

Although this list is considered useful because it provides categories of actors, the list is considered too detailed and too long for the purpose of this research, on one hand, and incomplete on the other hand. For example, researchers do not appear to play a role in this spectrum.

The important question is to what extent the actors identified by Goeller are really different. This question is answered by taking the spectrum and the rationalities distinguished in Chapter 2 as a starting point. It would be useful if the actor archetypes to be defined would fit the rationalities of Chapter 2. Unfortunately, that is not possible, because actors often reason according to a combination of rationalities as will be illustrated. So, an additional step needs to be taken. Actors are categorised into groups if they are expected to have a similar rationality.

The spectrum of policy analysis makes it easy to identify two actor archetypes that play a role at the far ends of the spectrum:

- Closest to the problem situation is the heterogeneous group of *political actors*. Political actors focus on the outcome of the analysis. These political actors are expected to have a *political rationality*.
- At the other end of the spectrum, closest to the analysis, are the *researchers*. Researchers focus on the content of the analysis and the learning effect it has on people involved (Twaalfhoven, 1999). They are, therefore, expected to have a *scientific rationality*.

As already stated in chapter 1, policy analysts are a kind of broker between the political actors and the researchers. Therefore, *policy analysts* can be identified as the third actor archetype positioned in between the problem situation and the analysis. Often, policy analysts tend to be situated a little closer to the analysis than to the problem situation but the role perception of the policy analyst determines very strongly his position within the spectrum. This is the reason why the arrows in the table are drawn on the left and on the right side of the policy analyst. If the policy analyst is more oriented to support the debate in the policy process, he shifts to the left in the spectrum towards a facilitating role. If the policy analyst wants to provide the commissioner with information, he shifts to the right. Policy analysts are expected to have a dominating *design rationality* but they have to take into account the other rationalities as well (Bobrow and Dryzek, 1987; Schön, 1983).

A policy analysis project is generally assigned to the policy analysts. Therefore, another actor that plays a specific role in a policy analysis process is the commissioner of the policy analysis. The *commissioners* are the fourth actor archetype and are located in between the problem situation and the analysis. A commissioner of a policy analysis process orders a policy analysis project from a team of policy analysts. The commissioner is expected to have a *combination of a managerial rationality and a political rationality*.

So, four categories result from this exercise. Table 4.2 maps the actor archetypes in the spectrum of policy analysis. In the continuation of this thesis the order in which the actor archetypes are discussed will be based on the spectrum from problem situation to analysis: political actor, commissioner, policy analyst, researcher.

Table 4.2: Actor archetypes in the spectrum of problem situation and analysis

Spectrum	**Problem situation**		**Analysis**
Actor archetypes	Political actor	Commissioner	Researcher
		← Policy analyst →	

The categorisation in actor archetypes is based only on their anticipated rationality; it by no means indicates that the real actors belonging to the same actor archetype have identical views. On the contrary: within the actor archetype political actor, actors with conflicting interests who prefer different scales may be involved. Within the archetype *researcher*, actors may have different perspectives on scale choices based on the different disciplines they represent. However, we expect actors within one archetype to follow the same general line of reasoning in their arguments, as will be discussed in Section 4.2.3.

Looking back at the actors that Goeller distinguished shows that they can be categorised into different actor archetypes. Table 4.3 serves as a feasibility test. In some cases, more than one actor archetype can be applicable depending on the specific situation.

Table 4.3: Categorisation of actors distinguished by Goeller defined as actor archetypes

Actors related to the problem situation	**Actor related to the analysis**
Policy maker → P	Problem poser → C
Implementer → P	Sponsor → C
Operator → P	Client → C
Decision maker → P or C	Member of the staff → C
Responsibility taker → C	User → C
Staff member → P	Policy analysis team → A
Persons affected by the problem situation → P	Policy analysis peer group → A
Lobbyer → P	Research program director → R
Advisor → P	Advisor to the analysts → A or R
Evaluator → P	Formal reviewer → R
Enforcer → P	Implementation planner → A

P = political actor archetype
C = commissioner archetype
A = policy analyst archetype
R = Researcher archetype

4.2.3. Description of the actor archetypes

The actor archetypes with their rationalities and perspectives on scale choices are described in more depth below. The goal of these descriptions is not to perform a complete psychological analysis, but to gain a better understanding of how different actors are involved in a policy analysis process, the different perspectives they have and the ways they may react.

Political actor archetype

As already stated, political actors are a heterogeneous group, consisting of both governmental institutions and stakeholders. Governmental institutions consider values such as equity, liberty, democracy, justice and community important. Stakeholders are also a heterogeneous group that can comprise private companies, pressure groups, political parties or local inhabitants. Stakeholders have in common that they want to protect their own interests, preferably gain some benefit for their constituency, and/or realise their personal political ambitions and want to conserve or enhance their own power. A difference between those two is that governmental institutions protect the public interests while the stakeholders often want to protect their own interests.

According to House (1983), the political actor is apt to see an issue in terms of advocacy or efficiency, or in terms of its impact on the quality of life. Therefore, they have in common that they will act opportunistically in such a way that their own interests or the values they represent are served best. So, political actors want scale choices to be beneficial primarily for their own interests. If they have an interest in the study, they also want the scale choices to be beneficial for the objectives of study that matter to them. They may use scale choices in a strategic way to get what they want.

Commissioner archetype

Commissioners want a study to finish within time and budget constraints, and achieve the objectives of study. Therefore, the commissioners have a managerial rationality. Often, the commissioners are also working for the government. Therefore, they often have a political rationality. The commissioners will view the study as a project and a process. Their way of acting is similar to the political actors, but they also want the objective of the study to be achieved because they are accountable. Depending on the situation, the time and budget constraints will play a more or less important role. In studies that are executed close to the political field, timing is often very important, so finishing in time may be a crucial boundary condition. The budget and time constraints will also play an important role in the making of scale choices. The commissioners who have an important stake in the study (at least that appears to be because they spend money to have the study conducted) want the scale choices to be beneficial to the objectives of study because they want the study to succeed. Also, their own (political) interests may play a role.

Policy analyst archetype

According to House (1983), the goal of policy analysts is a *good analysis*. Policy analysts are responsible for the design of the policy analysis process.

In general, policy analysts aim to find the problem behind the problem. Policy analysts are responsible for integrating information from disciplinary studies into, for example, an impact assessment. While defining the study, many choices need to be made (in interaction with the commissioners, and possibly also with political actors and researchers) regarding the problem to be addressed, the variables to be taken into account, the system boundaries, and so on. In the end, policy analysts want to contribute to the quality of decision making. Policy analysts design (and makes choices) in a rational way but they also try to be creative. The predominant rationality is the design rationality. The design rationality also comprises sufficient insight into the other rationalities. They aim for a functional balance between the other three rationalities: meeting the commissioner's wishes within the constraints of time and budget, demonstrating sensitivity to political issues, but also producing a study of good quality by scientific standards. They make the connection between the rationalities by switching between the different rationalities. To do so, they often play a different role when they communicate with people from different rationalities: so, when acting in the policy process the policy analysts often take on a scientific rationality and when acting in the research process they often take on the political rationality or a managerial rationality.

Policy analysts are often not only the designers of the study, but also the executors of the study. In that respect, an important objective of policy analysts is to complete a study that is successful. A study is successful if the objectives are achieved and the commissioners (and other actors involved in the policy analysis process) are satisfied with the process and the results. Therefore, policy analysts want the scale choices to be beneficial for the objectives of the study. Also, their own interests may play a role, because a study means work for policy analysts.

Researcher archetype
Researchers want to perform a study of high quality. They aim to conduct research that is scientifically valid, and of interest to them, for example because it involves investigating new phenomena or building more sophisticated models of conventional phenomena (Pröpper, 1989). Researchers want scale choices to be made in such a way that they contribute to valid research. Also, the objectives of the study may play a role in their own interests because, for researchers, performing a study means work. Within the research archetype, a distinction can be made in two groups: the systems researchers and the engineers. The systems researchers aim to gain insight into how the system works while the engineers are more practical and oriented towards designing options for solutions to problems.

Overview
Table 4.4 provides an overview of the differences between the actor archetypes. These actor archetypes are thought to be helpful in the classification of actors interviewed.

Table 4.4: Rationalities, challenges and perspectives on scale choices of actor archetypes

Actor archetypes	Political actor	Commissioner	Policy analyst	Researcher
Dominant rationality	Political	Managerial and political	Design	Scientific
Dominant view on policy analysis	Policy analysis as a process (to get what they want)	Policy analysis as a project and a process	Policy analysis as an artefact that needs to be designed	Policy analysis as research
Challenge	Getting what you want	Achieve objective of study within time and budget	Good analysis and a satisfied commissioner	Speaking truth to power
Scale choices should be beneficial for…	Own interests: political interests	Objectives of study Own interests	Objectives of study Satisfaction of the commissioner (Own interests: study means work)	Valid research Interesting research opportunities (Own interests: study means work)

4.2.4. Scale decision making

For a good description and study of the decision-making process, information is needed first about the input of the actors involved in the process:

- the individual preferences of the actors with regard to the different alternatives (already discussed in the previous section)
- the alternatives discussed (also determined by the actors involved)

(from Pellikaan and Hout, 1998; Janis and Mann, 1977).

In multi-actor decision making, the rational procedures, as described in Section 2.5.1, do not apply that easily. Individual actors may act rationally and determine their preferences in a rational way. The scale choices in multi-actor policy analysis processes are, however, often made in a multi-actor setting. Scale alternatives are discussed by the actors who are involved in the decision-making process on scale choices. The process of making the scale choices is facilitated by the policy analysts. The basic assumption that is made here is that policy analysts are responsible for the scale choices made because they are responsible for the design of the policy analysis process.

Policy analysts are faced with conflicting arguments and preferences of the actors involved. This may result in difficult dilemmas because tensions may exist between different alternatives. In a dilemma the alternatives are very difficult or impossible to unite and are always based on certain values (van Twist, 1998). The word ‘di-lemma’ originates from the Greek, meaning two propositions. These seemingly ‘opposed’ propositions are converging upon us simultaneously. “If we give exclusive attention to either of the pair, the other is likely to impale us” (Hampden-Turner, 1990, p 9). The difficulty is caused by the fact that both alternatives have advantages and disadvantages and both will lead to problems, and yet, a choice has to be made between two alternatives with competing values. The policy analyst deals with these dilemmas in a conscientious way by making rational trade-offs. Therefore, the assumption is made that the policy analyst makes a rational decision on scale choices.

A complex situation rarely consists of one dilemma. Often, multiple dilemmas exist that are interrelated. Handling dilemmas often requires making multiple, difficult trade-offs.
Two types of dilemmas are studied:

- Dilemmas that can be related to conflicts in the objectives of a study
  Sometimes, choices may have to be made that contribute to one objective of a study and counteract another objective. This can pose a dilemma for the actors involved to decide what objective prevails.
- Dilemmas that can be related to conflicts between actors
  Actors often have different objectives. Therefore, actors usually prefer different options. This can pose a dilemma for the commissioner and the policy analysts to decide whose interests prevails.

When the objectives of a study are related to the objectives of the actors involved, these two types of dilemmas will overlap.

Figure 4.3 provides a conceptualisation of the decision-making process on scale choices.

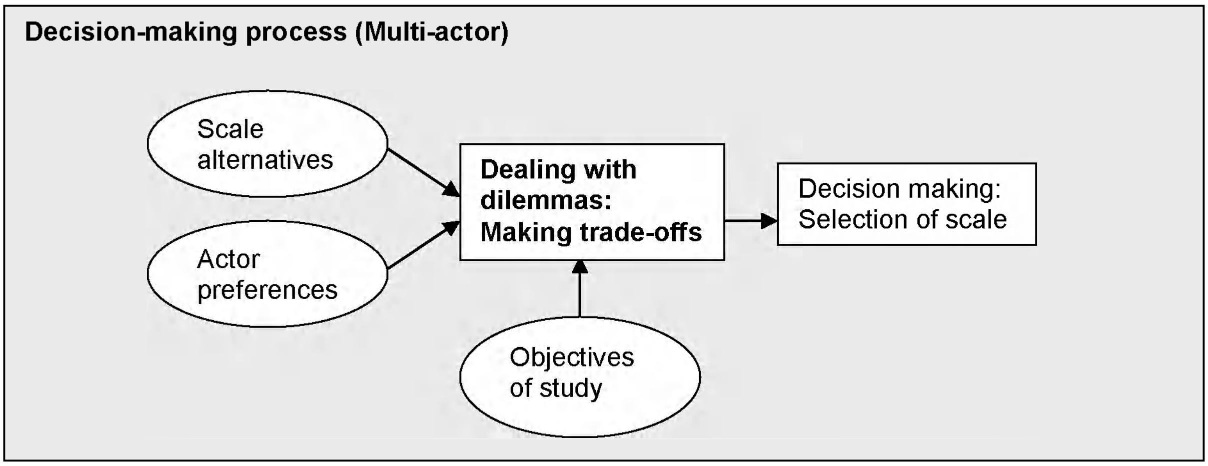


Figure 4.3: Conceptualisation of the decision-making process on scale choices

4.2.5. Effects of scale choices

The question is posed about the kind of specific effects scale choices have. Therefore, the effects are studied closely in practice and made more specific in the case studies. Scale choices are expected to have effects related to all four rationalities because the rationalities involve different values that are all closely related to policy analysis.

In Section 2.5 four rationalities present in policy analysis were elaborated on: the political rationality, the scientific, the design and the managerial. In order to know what kinds of effects scale choices have, it is considered useful to study these and to characterise them according to the rationalities.

4.2.6. Use of the conceptual model

To summarise, the conceptual model consists of three parts:

1. The actors determine their views on scale alternatives in a rational way. The actors' views are studied and the typology of actor archetypes (political actors, commissioners, policy analysts and researchers) is used to aggregate their views.
2. Actors involved decide on the scale choice by dealing with the dilemmas they are faced with. This process is facilitated by the policy analysts.
3. The scale choices result in effects related to the scientific, the political, the design and the managerial rationalities.

This conceptual model is used in the case studies in order to study how scale choices are made in practice. The specific questions that are answered by using the conceptual model are:

- What are the actors' views on the scale choices playing a role in the policy analysis process?
- What dilemmas play a role in making the scale choices?
- What kinds of effects of scale choices can be identified?

4.3. Selection of cases

Requirements and criteria

A proper selection of cases is considered very important (Eisenhardt, 1989). The cases were selected using common criteria to ensure a meaningful and proper comparison of them. Different categories of criteria played a role in the selection of the cases. The requirements and criteria are explained in more depth below and are summarised in Table 4.5 at the end of this section.

A generic boundary condition in all research is the *accessibility of information*. In the case of a completed study, the results of the study have to be available in reports. In the case of ongoing studies, the process has to be accessible. People involved have to be willing to cooperate in interviews.

Demands and criteria related to the relevance of the individual case

Six criteria played an important role in determining the relevance of the cases for the object of study:

- The application domain of this research is *water management*, so the case has to be located in this domain.
- The study is executed in a *multi-actor context* involving actors, preferably located at different scales with competing or conflicting interests.
- *Multiple spatial scales play an important role*
  Problems operate at multiple scale levels in which cross-scale interactions exist. In studies in which these conditions exist, scale choices have to be made intentionally because different options for scale choices exist.
- *Temporal scales play an important role*
  Case studies were selected that are vision-oriented policy analysis processes. Looking into the future is always a challenging endeavour because many uncertainties play a role. These forward looking and dynamic studies have a somewhat strategic character in the early stage of the policy process in which many options are still open. In these types of studies, there is room for discussion on scale choices because not a lot has been specified yet. A question that always plays an important role in vision-oriented policy analysis processes is what time horizon to use to look into the future.
- *Possibility to learn from the practice*
  Learning from practice is considered important in this research. Therefore, a condition is that scale choices were made conscientiously and carefully in the case study.
- *Policy analysts can be clearly distinguished in that role*
  In this research, only policy analysis processes that are carried out by independent policy analysis organisations are discussed. It is important to be able to make a clear distinction between the different actor archetypes. As seen in Chapter 2, policy analysis is a very broad professional field. Policy analysts can be found at all levels of government, in private consulting and within academia (Patton and Sawicki, 1993). Their main output is analysis and advice. Some characteristics of policy analysis organisations according to Weiss (1979) are:
  - they are permanent organisations with specialised staff
  - they do not have responsibility for operations
  - their staff have special expertise; most commonly the expertise is methodological
  - they are policy-oriented; their primary purpose is to improve the process and content of policy analysis

> The reason to select cases that are carried out by 'independent' institutes is that policy analysts working for the government will often also have a direct interest in the outcome and therefore operate as a political actor as well, which makes it harder to make a clear distinction in the actor archetypes. This is also illustrated by Patton and Sawicki (1993): "When they [policy analysts] are part of an ongoing agency they may become so closely identified with the programs of the agency that their analyses may not suggest much change from the status quo, may have a bias toward defending the agency's position, and may not be able to evaluate the policies objectively. Consequently, it is often argued that independent contractors, outside agencies, or other third parties can produce policy analyses that are more objective." (p 26).

Criteria to manage the variety in the combination of cases
Especially in exploratory research, Swanborn (2000) recommends minimising variation between the cases because minimum variation increases the reliability of the findings. If a lot of variables were different, it would be hard to draw conclusions from the comparison of the cases. Therefore, some criteria need to be kept constant in order to make a meaningful comparison feasible.

A variable that is kept constant is the approach to the policy analysis process. Policy analysis processes that are executed by the same group of policy analysts are selected to decrease the amount of variety in analysis. In studies executed by the same policy analysts the variety due to the difference in attitude, experience, methodology and approach among policy analysts is limited. This ensures that the difference in approach is mainly related to the different characteristics in the context and the orientation of the study itself.

A variable that is meant to be different is the role of the policy analysis process according to the hexagon model. This is done in order to increase the variety in types of studies and the roles they play in the policy-making process. Also, the phase in which I was involved in the policy analysis process is meant to be different. The variation in the phase in which I was involved makes it possible to study the various aspects related to scale choices more closely, such as making the scale choices, handling the scale choices and the effects they have.

Table 4.5: Overview of the demands and criteria

Category	Requirement	Criterion
Boundary condition	Information has to be accessible	• Availability of documents • Accessibility to the process • Willingness of actors involved to cooperate in interviews
Criteria related to individual case relevance	The domain is water management	-
	Multi-actor context	Actors with conflicting and competing interests are involved
	Spatial scale choices play an important role	In the context, multiple spatial scales can be recognised
	Temporal scale choices play an important role	The policy analysis process is vision-oriented
	Policy analysts can be clearly distinguished in that role	The policy analysis process is carried out by independent institutes/ companies with no direct interest in the outcomes of the policy analysis process itself
	Learn from the way scale choices are made in practice	Scale choices were made conscientiously and carefully
Criteria to manage the variety in the combination of cases	Minimise variety on some characteristics	Comparable approach to the policy analysis process
	Maximise variety on other characteristics	• Objective of the study according to the hexagon model • Phase of involvement of PhD-researcher

Selected cases

Two case studies were selected that met the criteria mentioned above:

- the Long-Term Vision of the Scheldt Estuary
- the Water Shortage Study of the Netherlands

The Long-Term Vision had a clear process orientation. Also, in the study, the managerial constraints (finishing on time) played an important role. The Water Shortage Study, on the other hand, had a dominant research orientation. Because the two case studies have different orientations that are typical for policy analysis, it is expected that the majority of arguments playing a role in making scale choices is visible in them. Also, the phase of involvement of the PhD researcher is different, which makes it possible to place emphasis on different parts of the process.

Long-Term Vision of the Scheldt Estuary

The Long-Term Vision of the Scheldt Estuary (LTV), was carried out *ex post* to be able to see what the consequences of the choices were. The Long-Term Vision of the Scheldt Estuary was a transboundary policy analysis process of the Scheldt Estuary in which both Flanders and the Netherlands were involved. This study was intended to support the building of a long-term vision for the estuary to solve the deepening issue that was a major source of conflict between the Flemish and the Dutch. Especially the spatial boundary setting was a controversial issue in this study and had large consequences. Also, the definition of long term was discussed extensively. The LTV mainly focused on the problem analysis and the design of four development sketches to achieve its long-term vision by 2030. The impact of the activities associated with the development sketches (deepening, for example) were described generally. The LTV of the Scheldt Estuary was a policy analysis process. A strategic environmental impact assessment (SEIA) was carried out as a follow-up study to study the effects of the options in more depth.

Water Shortage Study of the Netherlands
The Water Shortage Study (WSS) was an ongoing policy analysis process which made it possible to study the process of handling scale choices more closely.
The Water Shortage Study of the Netherlands is a national policy study that studied if and what measures should be taken to reduce problems in times of water shortage.
A critical question that played an important role in this study was how scale choices are made when there are so many interactions and relations between the different scales present. The study handled a multi-scale assessment involving actors on multiple scales through round table discussions and workshops. Other interesting issues were the handling of climate change and the shifts in the temporal scale during the study, and the difficulty in selecting a suitable level of aggregation in the presentation of the results.

4.4. Data collection

Sources of data
According to Denzin and Lincoln (1994), researchers in the social sciences have several methods for collecting empirical materials, ranging from interviews to direct observation, to the analysis of artefacts and documents, to the use of visual materials or personal experience. In the case studies, use was made of a combination of data sources: primary literature sources (project documents of the study itself and research reports directly related to the project), secondary literature sources (documents of interest to the case study, such as newspaper articles about the project, reports related to the project such as evaluations of the project, and second opinions related to the project), and interviews with different people who were involved in policy analysis processes that were used as cases. The documents gave more insight into the context, the study and the scale choices made. Interviews were held to find out more about the actors' views on the scale choices made. Table 4.6 gives an overview of the data sources. For each case study, a minimum of three sources of data were used, enabling triangulation of the data (Yin, 1989).

Table 4.6: Sources of information

Case study	Observation	Document analysis	Interviews	Secondary documents
Long-Term Vision - Scheldt Estuary	No	Yes	13 (ex post*)	Yes, newspaper articles, report Leemhuis-Stout, Roos
Water Shortage Study of the Netherlands	Yes, Phase 1 of the study and part of Phase 2	Yes	17	Yes, newspaper articles

* In the LTV, the interviews were held after the study had finished because of its high political sensitivity. Because the study had already finished when the interviews were held, the actors were aware of the impact of the selected spatial boundaries. This may well have influenced their opinion about the alternatives. Naturally, for the alternative spatial boundaries, they could only state what they expected that the impacts would have been.

Interviews

Asking questions and getting answers is a much harder task than may seem at first. The spoken or written word always has an element of ambiguity, no matter how careful the question is addressed and reported. Yet, interviewing is one of the most common and most powerful ways to try to understand our fellow human beings (Fontana and Frey, 1994). For each case study, semi-structured interviews were conducted with actors closely involved in the policy analysis process. A clear distinction in this respect is made between corporate actors and individual actors that was already explained in Section 4.2.2. One could argue that the interviewees are individual actors and do not represent the corporate actors. These individual actors, however, were involved in the policy analysis process as representatives of their organisations. This means they can be addressed as corporate actors.

Selection of actors to be interviewed

In the selection process, care was taken to interview at least three actors from each actor archetype (see Table 4.7). The first interviews were carried out with the project leaders and the commissioners of the project because they had a good overview of the actors who played important roles. They were asked about relevant actors to interview next. The remaining actors to be interviewed were selected using the 'snowball method': At the end of each interview, the question was asked regarding what other actors involved did the interviewee consider important. When the name of an actor was frequently mentioned, this actor was selected to be interviewed because he or she apparently played an important role in the process. The list of interviewees in the case studies is presented in Appendix 3.

Table 4.7: Number of actors interviewed in depth in each case study

Distinction in actor archetypes	**Long-Term Vision Scheldt Estuary**	**Water Shortage Study**
Political actors	3	4
Commissioners	3	2
Policy analysts	4	3
Researchers	3	5
Total	*13*	*14**

* the policy analysts were interviewed twice: once during the study and once at the end

Structure of the interviews

In general, four steps could be distinguished in the interviews:

1. *Calibration of actor archetypes*
   The interviewees were asked to classify themselves as one of the four actor archetypes (political actor, commissioner, policy analyst or researcher). This made it possible to cluster them into groups.

2. *Performance of thought experiment*
   The interviewees were confronted with a number of alternatives for the scale choices made in the case studies. This set of scale alternatives was created by perusing documents related to the case studies and from discussions with some of the actors involved. The alternatives were presented to the interviewees from large scale to small scale. The interviewees were asked to give arguments in favour of and arguments against the scale alternatives presented and the 'what if'-question: what would have happened if the scale choice was made that way. The first step in analysing the actors' views was to generate alternative spatial boundaries to be able to compare these alternatives with the selected alternatives.

3. *Actor preferences*
   The interviewees were asked what alternative they preferred and why. It was important to reveal the arguments behind the statements of preferences to gain insight into the causal relationships actors perceived between spatial scale choices and the consequences of those choices and how they valued the consequences.

4. *Process of making and handling scale choices*
   The interviewees were also asked to reconstruct the process of how the scale choices were made and what rationality was dominant in the process.

For a complete list of interview questions see Appendix 3.

The questions were not always asked in the specific order of the question list depending on the advance of the conversation and reactions to the statements. Also, there was room for additional discussion. In order not to guide the actors, but let them mention arguments, the questions asked were open-ended and no specific arguments were provided by the interviewer. This was also based on Twaalfhoven's (1999) experience: she defined criteria as *ex ante,* checked these criteria in the case studies, and concluded that these gave a distorted view.

The interviewees were informed about the objective of this research and asked whether they would object to be quoted in this thesis and related publications. The interviews were taped and later transcribed. In the case study chapters, statements by the actors interviewed will be quoted as part of the argumentation. All the quotes have been translated from Dutch into English.

4.5. Data analysis

4.5.1. Overview of steps in analysis

The primary goal of the data analysis was to retrieve substantive meaning from the collected data. Two generic steps were taken to generate insights from that information. On one hand, in order to analyse and present the data in an orderly fashion the conceptual model presented earlier in this chapter was made operational. On the other hand, information on individual perspectives was translated into an overall picture. The findings of the case studies were checked with the policy analysts in charge of the studies. Their comments were carefully incorporated into the final version of the case study chapters.

Different aspects were distinguished to formulate the conceptual model depicted in Table 4.8. These data analysis activities are explained in the next sections.

Table 4.8: Overview of the relationship between conceptual model and data analysis activities

Element in conceptual model	Data analysis operation	Specific activity
Actor perspectives	Analysis of selected scale	Description of the selected scale by constructing system diagram and actor analysis diagram Analysis of the actors' perspectives on the selected scale
	Thought experiment	Design of the thought experiment Description of alternative scale choices by constructing system diagram and actor analysis diagram Analysis of the actors' perspectives on scale choices
Scale decision making	Summary of the major dilemmas	Identification of dilemmas that played a role Construction of tension bow diagrams by using information from description of decision-making process and the actors' views
Effects of selected scale choice	Analysis of effects of the selected scale choice	Description of the most important observed effects Categorisation of effects according to the rationalities

4.5.2. Analysis of the selected scale and thought experiment

The analysis of the selected scale and the thought experiment are both split into two steps. The first step is the objective: it describes the consequences without attaching values to them. The selected scale is described by constructing a system diagram and actor analysis diagram. At the start of the thought experiment, first the alternatives that will be studied more closely were determined. This is called the design of the thought experiment. Then, the differences in scale choices will be studied by anwering the 'what if' question: what if the scale choices would have been made differently? What are the consequences of different scale choices on the system under study and the actor constellation? The constructed system diagram and actor analysis diagram of the selected scale serve as a reference point for the thought experiment. In the thought experiment, new system diagrams and actor analysis diagrams were constructed for each scale alternative in which changes in the system diagram and the actor analysis diagram compared to the reference point will be emphasised.

The second part of the analysis is aimed at getting insights into the actors' perspectives on the selected scale. It shows the actors' opinions and the values they attach to the consequences. Finally, in the thought experiment, the actors' perspectives on the alternative scale choices are described.

Part 1: Analysis of consequences on the system under study and the actor constellation

System diagrams

The scale that is used has consequences for the system under study. By using a different scale, exogenous factors may become internal variables or the other way around, and options and outcomes of interest may appear or disappear. For each of the scale alternatives in the thought experiment, a system diagram was constructed that marked the boundaries of the system by indicating the variables that play a role within the system (internal variables) and the variables that influence the system but are external (exogenous factors). Also, the options (possible solutions for the problems under study) that were taken into account were identified. The outcomes of interest give information about the behaviour of the system (Figure 4.4). The system diagrams were constructed by using arguments the actors used in the thought experiment and from project documents.

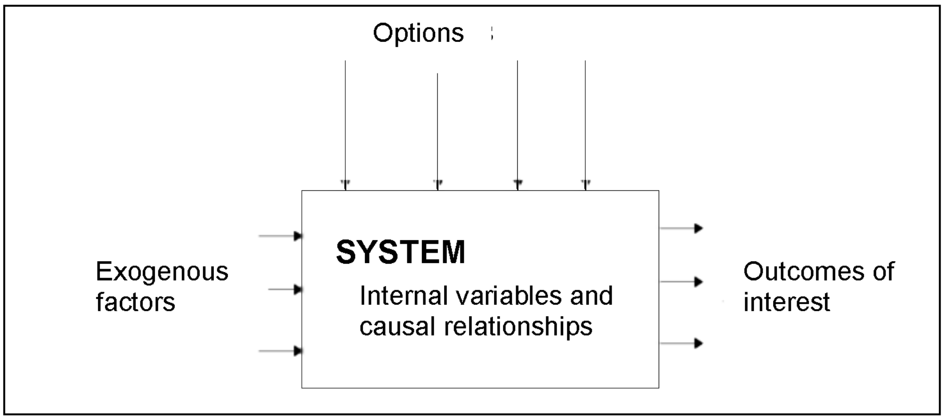


Figure 4.4: System diagram

Actor analysis diagrams

By changing the scale, actors may appear and disappear, and the positions of actors in the network may change (Vreugdenhil, 2005). Actor analysis diagrams (see Table 4.9) are used in this study to illustrate the differences in actors involved and their criticalness and dedication as a result of different scale choices.

A dedicated actor has an interest in the problem and wants to participate actively in the process to solve it, while a non-dedicated actor does not have that interest and stays at a distance (De Bruijn and ten Heuvelhof, 2002). A critical actor has the power to obstruct the process or the power to make the process succeed, while a non-critical actor does not possess the means to do this and can therefore be more easily ignored (ibid.). Without this critical actor it is more difficult to solve the problem; therefore, this actor should participate in the process. Critical and dedicated actors may have interests that match or do not match the goals of the process. This results in Table 4.9.

Table 4.9: Actor analysis diagram (from Enserink et al., 2001)

	Critical actor	**Non-critical actor**
Dedicated actor	• Potential allies that probably will participate and are needed in the process • Actors who may obstruct the process and probably will do so (biting dogs)	• Potential allies that probably will participate • Critic-casters who do not have the power to obstruct the process (barking dogs)
Non-dedicated actor	• Potential allies that are difficult to activate • Actors who may obstruct the process but are not expected to take action (sleeping dogs)	Actors who do not need to be involved

On a different scale, dedicated actors may become non-dedicated, and the other way around. Also, on a different scale, a non-critical actor may become critical, and the other way around. Therefore, for each scale alternative, an actor analysis diagram was constructed and the involvement, dedication and criticalness explained.

The actor constellation has important consequences for the management of the policy (analysis) process. When critical actors become non-dedicated because a different scale is used, it can pose a problem because they are needed but difficult to activate. Other actors (who are critical and dedicated on the selected scale) may have to be involved in order to solve the problem.

It is difficult to determine whether an actor changes position or not. To be able to determine the actor's criticalness and dedication, statements made by the interviewees were used and plausible explanations were given. Still, this method or strategy remains rather tentative.

Part 2: Analysis of actors' views

The objective is to get a better understanding of the views on scale choices and what their effects are. To be able to achieve this, it is necessary to understand the way in which actors evaluate the scale alternatives.

Translating arguments into criteria

By interviewing actors in an open way, there was a lot of room for specific arguments that played a role in the evaluation of scale alternatives. This had both advantages and disadvantages. The arguments that were mentioned were case specific. This made it possible to learn what arguments play a role in what kind of situations. On the other hand, the disadvantage was that the specificity of the arguments mentioned made a comparison of arguments difficult and an additional translation/aggregation step was needed to make such a comparison feasible.

To be able to articulate the views on scale alternatives in a more uniform way, the interviewed actors' arguments were translated into criteria. In this research, a *criterion* is defined as a factor that is used by an actor to judge a situation, in this case the effect of the scale choices. Important requirements for the formulation of criteria are:

- A criterion is a factor that can increase or decrease
- A criterion is neutral and has no intrinsic value. It is possible to be in favour of an increase or a decrease in the factor. The actors attach a value to a criterion to determine whether they consider it an advantage or a disadvantage.

Two examples of criteria and their value are given here:

- The availability of more options can be regarded as an advantage by the designer of the study who wants to prevent premature closure, while a political actor in favour of the option under study regards it as a disadvantage. Both use the same criterion (number of options).
- An actor in favour of a quick result of the study might be in favour of involving as few actors as possible. An actor who wants to delay the study might be in favour of involving as many actors as possible. Again, both use the same criterion (number of actors involved).

Criteria may also have a close relationship to each other. For example, the criterion *number of actors* in the last example influences the criterion *time needed for study* and *the protection of interests of an actor in favour of a quick result*. Care was taken to stay as close as possible to the advantage or disadvantage that was mentioned. Nevertheless, it was impossible to translate advantages and disadvantage into criteria without any interpretation. To prevent suggestiveness and personal bias as much as possible, an expert on policy analysis research was also asked to translate the advantages and disadvantages 'from scratch' into criteria as a check. The translations were compared. Globally, the translations were the same and any differences of opinion were discussed and settled.

Use of score cards

Score cards, also called impact assessment tables, were used to be able to give quick insight into the views on scale choices of different actor archetypes. Based on the data that were collected, insight was generated in their different views on scale. The criteria were extracted from the arguments in favour of and against each alternative mentioned by the interviewees and aggregated to the actor archetype level. The effects were presented as an increase (↑) or decrease (↓) in each criterion compared to the selected alternative. In that way, no value was attached to it.

The assessments could not easily be transformed into score cards (Miser and Quade, 1988), because the different actors' views precluded unequivocal ranking. Each scale has advantages and disadvantages and—more importantly—whether scale effects are considered as advantages or disadvantages also depends on the actor's view. By assessing the effects from the perspectives of the different actor archetypes, insight could be gained about how the effects were valued by each actor archetype: + means valued positively by the actor, - means valued negatively by the actor.

The rules that were used in making score cards include:

- If something is called an argument in favour, it more or less implies that the other alternatives score less on this criterion, but that is not certain. Therefore, the alternative for which the argument *in favour* was used gets a + and the other alternatives get a 0.
- If something is called an argument against, it more or less implies that the other alternatives score better on this criterion. The alternative for which the argument *against* was used gets a - and the other alternatives get a 0.
- Some exceptions exist that can easily be derived from the context. For example, when an interviewee states the decrease in the validity of the study in 2030 is a disadvantage because it is so far away, it can be logically deduced that he/ she will think that its validity in 2050 is also lower and is also regarded as a disadvantage.

Box 4.1 summarises the definitions of the keywords above.

Box 4.1: Important definitions in the conceptual model	
Criterion	A factor that is used by an actor to judge a situation, in this case the effect of the scale choices. A criterion is a factor that can increase or decrease, it is neutral and has no intrinsic value.
Effect	An increase or decrease in each criterion compared to the selected alternative.
Value	The way an actor archetype evaluates the effect of a scale choice
Score card	An impact assessment table, used to be able to give a quick insight into the views on scale choices by different actor archetypes.

4.5.3. Summary of the major dilemmas

As was explained in Section 4.2.3, multiple dilemmas exist concerning scale choices. It is important to clarify the specific dilemmas involved in making scale choices in different situations. To be able to present the dilemmas in an orderly fashion, a method is needed that helps to identify and communicate those dilemmas. Van Twist et al. (1998) propose a visualisation method that was considered helpful, called tension bow diagrams. Tension bows can be used by policy analysts to clarify the dilemmas and to make them transparent for other actors involved. Tension bows make very explicit what the crucial differences between the alternatives for scale choices are by showing the values on which two alternatives contradict. Also, they show what kinds of trade-offs have to be made in the making of the scale choice. In the tension bow, the major values related to the alternatives are discussed. The trade-offs involved are visualised as tension bows that connect two positive values: one associated with each alternative. The two values that are on each side of the axis are (closely) related to each other. Of course, it depends on the actor's view whether this value is actually valued positively. A guideline used during the construction of the tension bows was that at least one actor involved should evaluate the value as positive and the value must be formulated in a positive way. When several trade-offs were involved, often these were interconnected and could not be made separately. The dependence of the trade-offs was visualised by grouping the values to the alternative. By selecting a specific alternative, the values of the dilemmas in the tension bow diagram were automatically selected that were related to that alternative.

The limitation of tension bow diagrams is that the values of only two alternatives can be displayed. If more than two alternatives are involved, tension bow diagrams would need to be constructed to show all dilemmas involved. In this research, however, only one tension bow diagram was constructed to visualise the two most important alternatives. The reason for this choice was that the dilemmas involved, when using the other alternatives, were less pregnant because there were plausible reasons for these alternatives not being selected.

4.5.4. Analysis of effects of the selected scale choice

Description of the most important effects

The actual effects of the scale choices made were described by using statements by the interviewees about them and by the researcher's review of the documents and practice. A difficult issue in the description of the effects of the selected scale choice was the causality between scale choices and their effects. To be able to describe the effects, a causal relationship was assumed between the scale choice and the effect. It was considered impossible to establish a direct causal relationship between the scale choices and the effects because lots of other factors may have played a role besides the scale choices. Also, a causal diagram of effects was constructed to show the relationships between the effects, because the list of effects itself looks rather heterogeneous at first sight and, therefore, does not contribute to its understanding. It is emphasized here that the relationships are plausible and tentative.

The main objective was to find out whether scale choices actually contribute to the achievement of the objectives of the policy analysis process because one of the major normative starting points in this thesis was that scale choices have to be made in such a way that they do contribute in that way. This was difficult to assess, but plausible arguments and tentative explanations were given as well. It must be noted that for this research it was not considered important whether the objectives of the policy analysis process were actually achieved.

4.6. Structure of presentation of case study results

4.6.1. Overview of presentation

The case studies, Long-Term Vision of the Scheldt Estuary and the Water Shortage Study of the Netherlands, are first described in two separate chapters, Chapters 5 and 6. Both cases are described using the same structure. The analysis of the scale choices is, however, not presented separately, as might be expected. Instead, it is ordered along the dimension of the unit of analysis, the scale choices. One of the reasons for this order is that, when multiple cases are carefully ordered along the key dimension, powerful explanations are more likely (Huberman and Miles, 1994). Another reason is that it adds to the simplicity of the structure because it is possible to compare the specific scale choices made in the case studies within the chapters themselves. Chapters 7 to 9 on analysis of the scale choices in the case studies have a similar structure because use is made of the same conceptual model. Chapter 7 deals with the analysis of the spatial boundary setting of both cases, Chapter 8 covers the temporal boundary setting of both cases and Chapter 9 deals with the selection of the level of aggregation in both cases. Figure 4.5 provides an overview of the structure of presentation of the case study results.

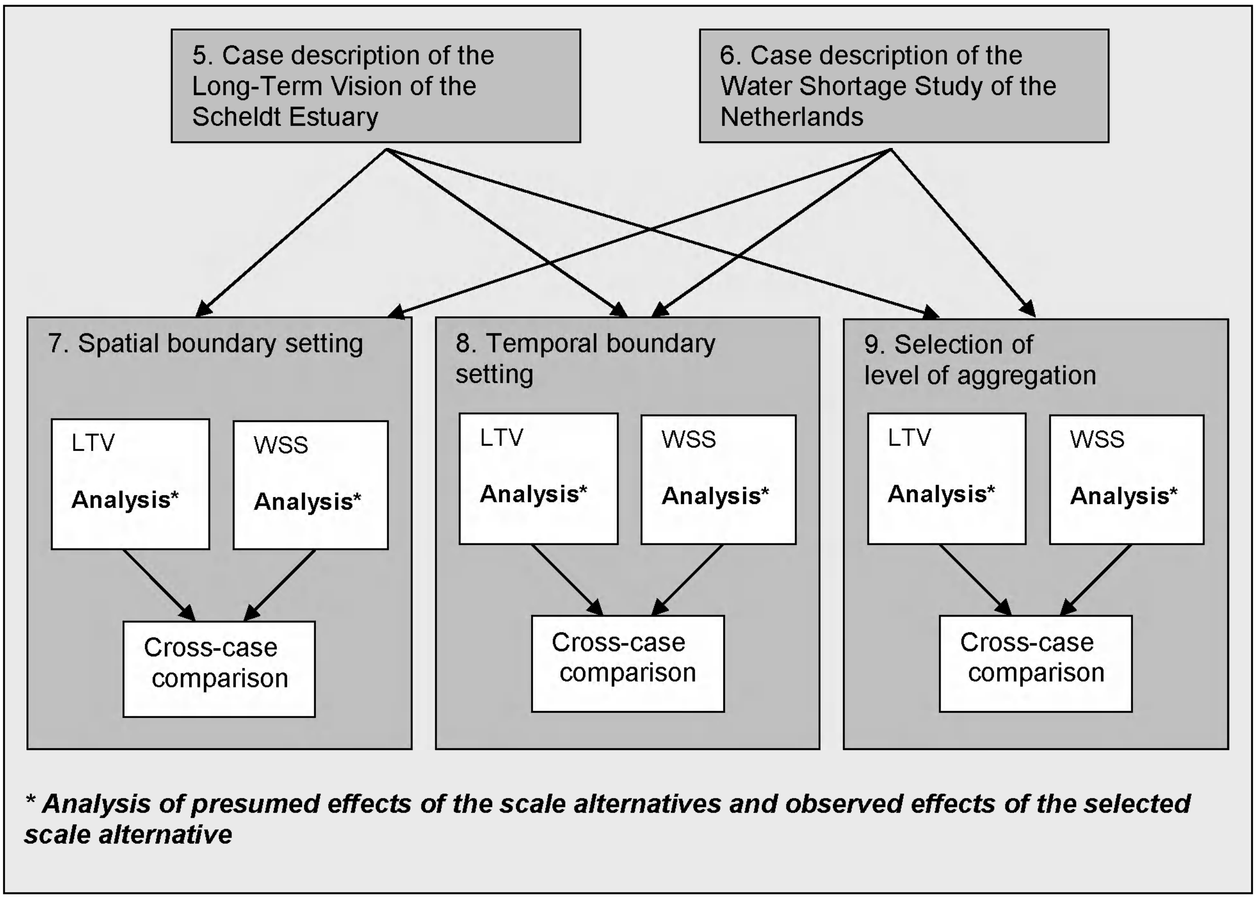


Figure 4.5: Overview of structure of presentation of case study results

4.6.2. Presentation of case study descriptions

The goal of the case study description is to introduce the context of the problem and the policy analysis to the reader. Also, the process of making and handling the scale choices is described. Yin (1994) distinguishes six alternative structures for the composition of a case study description: linear-analytic, comparative, chronological, theory-building, suspense and unsequenced structures. In this case description, the chronological structure seems useful to provide because a chronological structure allows the reader to quickly grasp the important issues related to the case study. Also, causal relationships between making scale choices and how they were handled during the study are easier to depict.

In the case study description, first, an introduction to the context of the problem and the study itself is provided for both cases. Also, the decision-making process on scale choices and the handling of those choices during the study are described. The reports of the policy analysis process and documents related to that study were analysed to gain insight into the context of the problem, the objectives of study and the decision-making process of scale choices.

As could be noticed in Section 3.6, different scale decisions (analysis scale/ observation scale/ presentation scale) in the design of a policy analysis process need to be made. It would be too complicated to analyse **all** the scale choices that are made. Therefore, in the conclusions of the case study descriptions, a selection is made of the most interesting scale choices that played a role in the study and that are going to be analysed. The indicators that are used for the selection are:

- Controversy: different actors have different preferences and attach a high value to the consequences
- Challenging dilemmas
- Discussion/ adjustment during the process

The information related to these indicators was obtained by reviewing the documents and in consultation with the policy analysts involved.

Table 4.11 provides an overview of the elements that played a role in the case study descriptions.

Table 4.11: Elements of the case study descriptions

Element	Description/ analysis of….
Context	Background Problem situation Actors involved in the problem situation
Policy analysis process:	Assignment Objective of study and managerial constraints Project approach Organisation
Scale decision making	Actors involved Alternatives discussed Decision making process Selected scale Major dilemmas
Scale handling during the study	Distinction in scale-related rounds according to Teisman's rounds model
Results and aftermath	General conclusions of the study Handling of scale choices in the aftermath
Conclusions	Major conclusions

4.6.3. Presentation of case study analysis

The elements that are used in the case study analysis presentation in Chapters 7, 8 and 9 are the results of the thought experiment, the dilemmas and the effects. Table 4.12 provides an overview of the presentation of the case study analysis.

Each chapter concludes with a cross-case analysis in which both cases are compared to find similarities and differences. Comparative analysis can bring more understanding (Miles and Huberman, 1994). The reason to perform a cross-case analysis is to enhance generalisability. Each case must be understood on its own terms, yet the important learning points can be revealed by comparing the cases to see what is case specific and what is more generic. A second, more fundamental reason is to deepen understanding and the explanation. An explanation for the observed similarities and differences was sought. The aim was to understand how processes and outcomes in different cases are qualified by case-specific conditions (Miles and Huberman, 1994).

Table 4.12: Elements in the case study analysis presentation

Data analysis operation	Description of the….
Analysis of the selected scale	Systems analysis Actor analysis Actor views
Thought experiment	Design of thought experiment: scale alternatives Systems analysis Actor analysis Actors views of the scale alternatives
Analysis of effects of the selected scale choice	Most important mentioned and observed effects of the selected scale
Cross case comparison	Similarities and differences in cases

5. Case description of the Long-Term Vision of the Scheldt Estuary

When the decision was made to make a Long-Term Vision for the Scheldt Estuary, nobody knew how to do that. The first question that was raised was: What are we talking about? Which area is discussed? What are the boundaries of the estuary? And what is long term?

-Pers. com. Political actor, Long-Term Vision of the Scheldt Estuary, 2004

5.1. Context

5.1.1. Background

The basin of the Scheldt River is located in Northwestern Europe and stretches over three countries: the Netherlands, Belgium and France, with a total length of 350 kilometres. The Scheldt basin is exploited extensively by the riparian states, which have assigned several user functions to the river. An important function of the Scheldt is navigation. The Scheldt Estuary is the maritime access to the Port of Antwerp, one of the biggest ports in the world. Antwerp is situated in Flanders, which is one of the three communities of the federal state of Belgium. Flanders has its own parliament, government, administration, and its own language (Dutch). In spite of the extensively exploitation of the Scheldt, the estuary has a tidal system with high ecological value and potential. The Scheldt is unique in that it is the only macro-tidal estuary in Northwestern Europe to still exhibit inter-tidal marshes along its entire length (to Ghent) and to retain a full salinity gradient from marine to freshwater (Meijerink, 1998).

5.1.2. Problem situation

An asymmetric distribution of interests and resources is present in the Scheldt Estuary. Belgium, situated upstream from the Netherlands (see Figure 5.1), is dependent on the Dutch for the maintenance and improvement of maritime access to the Port of Antwerp. On the other hand, the Dutch depend on the Belgians for the water quality because the water quality of the Scheldt in the Netherlands is influenced by upstream activities like pollution by industries in Belgium and France. So, a mutual dependency exists.

One of the most prominent policy issues over many years is the deepening of the Scheldt waterway. This is considered necessary to keep the Port of Antwerp accessible, in view of the steadily increasing size of container vessels. It is expected that the actual tide-dependent depth in the (near) future will hamper the economic development of the region. The problem is that the deepening program has to be carried out on Dutch territory for the Belgian Port of Antwerp.

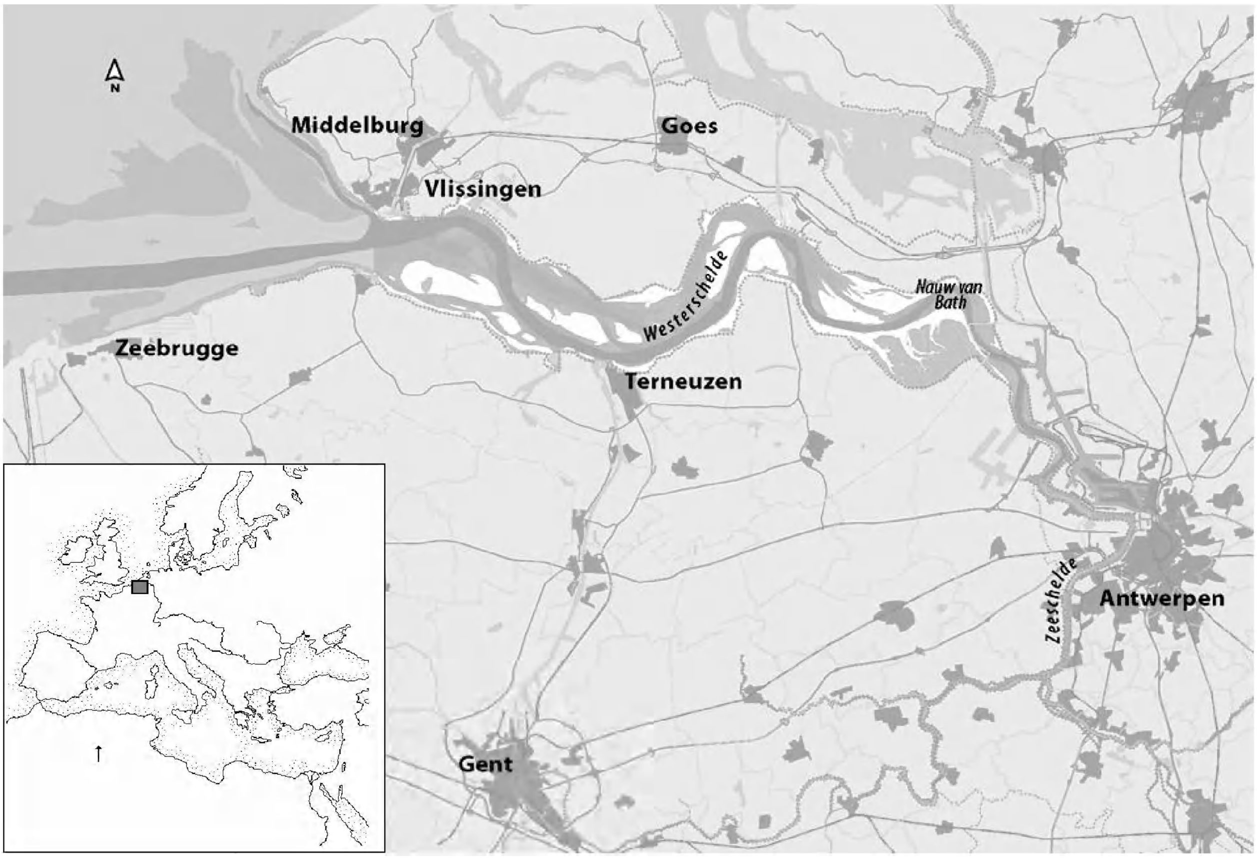


Figure 5.1: Map of the Scheldt Estuary (in Dutch) (source: http://www.proses.nl) with sketch map of Europe

The Netherlands and Belgium both recognise the importance of access to the Scheldt ports, the value of a dynamic ecological functioning of the estuary, and the need to guard against flooding. In the policy discourse, Flanders has emphasised the economic function of the Scheldt Estuary while the Netherlands has emphasised its ecological value and the risks of transportation of dangerous substances. For Flanders, the Scheldt is the most important economic transport medium because it connects the Port of Antwerp to the sea. For the Netherlands, the Scheldt is one of many transport channels. In the Netherlands the most important ports are in Rotterdam and Amsterdam. The smaller Dutch ports of Flushing and Terneuzen, located along the Western Scheldt, are of regional importance but of limited national importance. The unique habitats present in the Scheldt Estuary are lacking in the access channels to Rotterdam and Amsterdam. Consequently, the Netherlands has emphasised the ecology in the Western Scheldt more than the economy (Santbergen et al., 1998).

When Belgium was segregated from the Netherlands in 1839, treaties were signed for the large joint infrastructures. The far-sighted Belgians insisted on a clause that would guarantee free access for ships to the Port of Antwerp. In 1925, the two nations agreed that, when necessary, the Scheldt would be deepened. A treaty for deepening the waterway to the tide-independent depth of 11.6 metres was signed in 1995. In this treaty, also a clause for nature compensation was included as a way to persuade the Dutch parliament to agree to the deepening. This deepening was carried out in 1997-1998. The province of Zeeland and

various nature organisations were kept outside this entire procedure, to their dismay. They felt that there were many disadvantages but were not allowed to say anything while decisions were being made concerning their region. This matter had just passed when Antwerp requested the next deepening in 1998.
However, part of the work on nature compensation was still in progress when the discussion of a further deepening started. The decision for compensation was made at a high governmental level but in practice it appeared not to be entirely feasible. The Flemish paid a large amount of money for the nature compensation that had to be conducted following the European Habitat Guidelines. This program consisted of de-poldering some areas in the province of Zeeland. The inhabitants of Zeeland (especially the farmers), however, fiercely objected to this de-poldering, so hardly anything had been done by the time the discussion of a further deepening started. The European Union declared the Netherlands in default for this.

The Belgians maintained that the steady increase in the size of container vessels required further deepening to a tide-independent depth of 13.2 metres so that the economic development of the region would not be constrained in the (near) future. For the Dutch governmental actors, it was clear that further deepening would be a very sensitive issue both in zeeland and in the National Parliament. A factor contributing to this sensitivity was that the environmental impacts of the recent deepening on the estuary's ecosystem were, as yet, unclear. It was, for example, expected that the deepening would result in an increase in the current flow velocity and an increase in the dynamics of the system which might form a threat to the estuary's ecological value and to the multi-channel system.

5.1.3. Actors involved

A lot of actors have an interest in this problem. A distinction in made between governmental actors and stakeholders. Table 5.1 displays an overview of the governmental actors involved in the problem situation and Table 5.2 shows the stakeholders involved. Also, their general interest and their interest in the problem situation is depicted.

Table 5.1: Governmental organisations involved in the problem situation of the deepening issue of the Scheldt

Actor	General interest	Interest in the problem situation
Dutch Ministry of Transport and Water Management	Safe and good transport and good accessibility Good water management: Safety against flooding, sufficient water for all functions, good quality of water	Solve the issue more permanently because the deepening is a continuous source of discussion with the Flemish. Some say the Ministry of Transport and Water Management has little interest in the deepening and therefore did not hurry to get things done. Flemish actors accuse the Ministry of not wanting the deepening because it might weaken the competitive position of the port of Rotterdam.
Ministry of the Flemish Community (AWZ)	Flemish economy and safety against flooding	In favour of deepening, because the Port of Antwerp is the most important engine of the Flemish economy
Flemish Ministry of the Environment (AMINAL)	Preservation of the environment	Follow the EU guidelines on nature conservation. Develop nature in Flanders as much as possible.
Province of Zeeland	Development of the Province of Zeeland	Against the deepening because of effects of the previous deepening are not known yet and against the de-poldering.
Water board	Safety of the region Water management of the region	Against the deepening, afraid of erosion of levees by large current velocities and against de-poldering
Municipalities in Zeeland	Development of municipalities	Against the deepening because concerned with the consequences of the deepening for the tourism industry and against the de-poldering.
Technical Scheldt Commission	Good policy making and maintenance in the Scheldt Estuary	Improve the relation between the Netherlands and Flanders by resolving the conflict situation on the deepening of the Western Scheldt.

Table 5.2: Stakeholders involved in the problem situation of the deepening issue of the Scheldt

Actor	General interest	Interest in the problem situation
Port of Antwerp	Continuity and profit of the port of Antwerp	In favour of deepening on a very short term
Port of Zeebrugge	Continuity and profit of the port of Zeeburgge	A chance for expansion if the deepening of the Western Scheldt continues to be a problem
Ports in Zeeland	Continuity and profit of the ports in Zeeland	Divided interests: Some ports in Zeeland are against the deepening because they fear that their competitive position will weaken. Other ports say that the deepening is good for their competitive position
Nature organisations (Dutch and Flemish)	Good condition of the ecological systems, preservation of unique habitats	Against the deepening because they fear the consequences of the deepening for the ecological system
Tourism sector	Flourishing tourism business	Against the deepening because of fear of the consequences of the deepening for the tourism industry (higher current flows, greater erosion of the beaches)

Agriculture sector	Continuity of business	Strongly against the deepening (both Belgian and Flemish farmers) for several reasons. First, the deepening is thought to be compensated for by de-poldering. The locations that are mentioned as search areas for de-poldering are often agricultural lands. Also, the effects of many measures that are thought to be beneficial for nature are unclear. For example, the effects of hydrological measures on the leakage of salt/ brackish water were discussed because the measures may lead to more leakage of salt water into the agricultural land

5.2. Policy analysis process

5.2.1. Assignment

The director of the Port of Antwerp managed to get the issue of accessibility of the Port of Antwerp on the agenda of a meeting in 1998 between King Boudewijn of Belgium and Queen Beatrix of the Netherlands. This started to get things moving. Because the previous deepenings were preceded by drawn out, troublesome and costly procedures, the Dutch Minister of Transport, Public Works and Water Management and her Flemish counterpart decided that a vision for the long-term future of the Scheldt Estuary should be developed in joint cooperation. They hoped to resolve the deepening issue once and for all with a comprehensive study. A study into the deepening alone was not politically feasible, therefore, a broader process had to be started including not only the deepening but also other important aspects playing a role, like safety and the preservation of the ecosystem. The project, called the Long-Term Vision for the Scheldt Estuary, was started in June 1998 and was finished in January 2001.This resulted in a unique project in Europe because of its transboundary character: it was decided upon by the two countries together.

5.2.2. Objectives

The objective of the policy analysis process was to create an integrated joint long-term vision for the Scheldt Estuary. The long-term vision itself was formulated in abstract terms as follows:

"The Scheldt Estuary is in 2030 a healthy and multi-functional estuarine water system. The system is used for human needs in a sustainable way" (Ministerie van Verkeer en Waterstaat et al., 2001b, p.8).

This long-term vision was thought to provide a basis for the development of a bilateral, integrated policy on the Scheldt Estuary. Besides, it was expected that a joint development of a joint vision would help build trust and improve cooperation between the parties involved (Ministerie van Verkeer en Waterstaat et al., 2001a).

In the interviews, all political actors and policy analysts emphasised the joint aspect of the vision building. Words often used in the formulation of the most important objective of the study were agreement, consensus and good neighbourliness. A political actor noted:

> *Good neighbourliness has been very important for the Dutch national government the last couple of years. They consider it important to strengthen the relation between the Netherlands and Flanders. It can not be denied that a number of nuisances are present. Examples of those nuisances are the Scheldt dossier and the Iron Rhine dossier which led to heavy debate.*
> *The position of the Netherlands and Flanders in the EU is getting weaker so both countries benefit from a good relation in which they unite their interests.*

The commissioners considered it very important to get coherence between different functions of the Scheldt Estuary as a starting point for the follow-up on both sides of the border. A commissioner said:

> *An important goal was to create understanding that in the future not only accessibility is important, but a joint acting of both countries to serve the different functions such as environment at the same time. We had to find a mode to get a discussion going and to keep it going considering the situation that was present.*

The researchers saw the LTV as an opportunity to bring in their knowledge and build a vision that had a scientific base. A researcher stated it as follows:

> *In my opinion the most important goal of the LTV was bringing together the existing knowledge in order to make a coherent vision. This was an opportunity for us to promote a vision that encloses the system in a scientifically well-founded way and to communicate this to the policy makers. In this way we could make sure that policy making finally would be based on scientific expertise and objectivity. This also provides more power in discussions on accessibility and safety because it all has a scientific base.*

Classification of objectives of the study and managerial constraints
If the Long-Term Vision has to be classified according to the objectives as mentioned in the hexagon model (Mayer et al, 2004), it is clear that the main objective of the study in the eyes of the commissioners was to resolve the conflict over the deepening issue. Mediation, therefore, played an important role in the study. An additional objective was to provide insight into policy measures because global options had to be formulated to reach the long-term vision. This objective coincides with the activity of *design and recommend* in the hexagon model.

Before the project started it was decided that the project had to be finished within two years time. For such an extensive project this was an extremely difficult task. This limited time frame had to do with the distrust on the Flemish side that the Dutch were trying to delay the entire process. Therefore, it was also important for the building of trust to finish the study within time. According to some of the involved Flemish political actors, also the strategic goal of *shelving* appeared to play a role in this study: they felt that while they were waiting anxiously for the deepening to go ahead, the LTV was being started and used to postpone the next deepening phase (Blomme, 2001). The reason for this delay, according to the Flemish, was that the Netherlands were worried about the competitive position of Rotterdam (Blomme, 2001). A Flemish political actor explains:

> *If we negotiate with the Dutch on issues where the advantage for the Dutch is not evident, the Dutch always follow a certain tactic. They always say: "We are all European citizens and we must try to find a solution for this problem. Good neighbourliness is very important. We will take up a constructive position. But to maintain the nation in a good way, we must study closely what the positive and negative consequences are, whether the project is necessary, what the consequences for the environment and the effects for the economy are, what risks are involved." I have never known how sincere the Dutch are. It is a way of acting that I have*

seen in different situations, for example also in the Iron Rhine issue. One round of studies leads to the next round of studies. To obtain support a difficult and time consuming participation path is followed. After the hurdle of the studies is taken, the hurdle of financing comes into sight. I have the feeling that the projects are made extremely expensive by introducing far-reaching environmental measures to create a new barrier.
In the meanwhile the train has become so long that the risk becomes large that the entire project does not get off the ground anymore. A lot of issues are attached, for example safety, environment and economic effects for companies in Zeeland. Only little goodwill seems to be present despite all the nice words that are spoken on official occasions.

Therefore, the Flemish insisted that the study had to be finished within a relatively short timeframe because urgent interests were at stake.

Another reason to stay within the time allotted had to do with planned elections in the Netherlands. When the study was started, the election date was taken as a moment at which the study had to be finished, so that a decision could be made before the elections. A commissioner, however, put this into perspective and noted:

If politicians could score with the study, they would make a decision before the elections. If it was neutral, they could decide themselves whether they would postpone it until after the elections or decide themselves. If it turned out negative, we would not have done our job well enough, and the decision would be postponed till after the election.

Table 5.3 summarises the objectives of study.

Table 5.3: Overview of objectives of study (from the perspective of the commissioners) and managerial constraints of the LTV

Formal goal of the study	**Major activities**	**Strategic goal of the study**	**Managerial constraints (time and budget)**
Solve conflicts Provide insight in policy measures	Mediate Design and recommend	Shelving (the Flemish accused the Dutch of this strategic goal) Rationalisation (the Dutch accused the Flemish of this strategic goal)	Playing a prominent role (especially time)

5.2.3. Project approach

The first step towards the creation of a joint vision was an exploration of joint objectives, priorities and possible subjects involved in policy frameworks. This was called *agenda setting*. During the agenda-setting phase, the scale choices were discussed and made. Finally, this step resulted in an agreement about the agenda which became the basis for the content and the ways of cooperation. Many issues played a role, but finally priorities were set on the following aspects, considered later on in the study:

- Economic aspects: the accessibility and economic future of the ports along the Scheldt
- Natural aspects: the dynamic character of the unique ecosystem
- Safety aspects: flooding and dangerous goods transport
- Morphological aspects: the multi-channel system

(Ministerie van Verkeer en Waterstaat et al., 2001a)

The aspects under consideration operated on different system scales, which are shown in Table 5.4.

Table 5.4: Overview of the scales of the most important systems in the LTV

System	Scale
Economic system	Western Europe, or at least the Hamburg/Le Havre range
Ecological system	River basin
Morphological system	Western Scheldt (sluice at Antwerp forms a clear boundary)
Safety system	Western Scheldt to Antwerp

The agenda-setting phase took almost a year (March 1998- January 1999). After the agenda setting, preparations for the execution started. The agenda was elaborated into work plans for several working groups that prepared the long-term vision. The working groups consisted primarily of government officials, but several scientific advisors provided support. In the first phase of the project, three working groups were installed: Safety, Accessibility and Ecology. In this way the research questions were formulated by people who had to make the policies later. In Flanders the ministries of AWZ and ANIMAL were closely involved. In the Netherlands the Ministry of Transport and Water Management was involved by a delegation from the regional department (Zeeland). The researchers mainly got involved in the working groups in the second phase of the project which took place from September 1999 to December 2000. The working groups all focused on the following activities:

- Analysis of the current situation and the current policies resulting in agreement about the situation sketch in the short term.
- Development of policy goals for the long term (in Dutch often referred to as Streefbeeld)
- Development of alternatives of measures in four development sketches. The emphasis of the Long-Term Vision was put on generating options on a highly abstract level.
- The assessment of effects. This was done in a very quick and 'dirty' way using a qualitative approach.

The specific activities of the working groups included:

- Research on accessibility of the harbours: The key issue of the economic research was the accessibility of the Scheldt Estuary in relation to the competitive position of the four ports of the Scheldt (Antwerp, Ghent, Terneuzen and Flushing) in the long term. Attention was given to the composition of the loads of the ships (containers or bulk material), strengths and weaknesses, the nautical accessibility and plans for the future. The first deepening had led to an increase in traffic and to the use of larger ships, causing the Port of Antwerp to grow more rapidly than the other ports in the Hamburg-Le Havre range.
- Research on the natural condition of the estuary: In the study on naturalness, a vision was formulated for the ecosystem of the Scheldt that could be used as a starting point to evaluate the effects of the deepening in the Scheldt Estuary. Naturalness demands a flexible system that is not contaminated and as large a variety in dynamics and space as possible, one that results in sufficient space for and diversity of habitats.
- Research on safety against flooding: The goal of the safety study was to find an optimal protection level and to determine the safety measures needed.
- Research on the morphology: the influences of the deepening on the multi-channel system were studied (this group was later installed).

5.2.4. Organisation

The project was executed by a bilateral project organisation (see Figure 5.2). The Dutch Ministry of Transport and Water Management and the Ministry of the Flemish Community decided to delegate the study to the Technical Scheldt Commission (TSC). In this way the TSC became the commissioner for the study. The TSC was founded as a commission that prepares decision making on joint issues related to the Scheldt between Flanders and the Netherlands. The Technical Scheldt Commission reported to the ministers. This delegation was considered very strategic, as the chairman (at that time) of the TSC explained:

> *The study was clearly policy oriented, therefore the real commissioners are the Directorate Generals of the Ministry of Transport and Water Management. For the study it was, however, important to make the decision makers not responsible for the project. It was a very delicate process, in which we had to be careful what we did and said. Then it is not handy to involve the decision makers, because if they make statements that block the process they cannot do anything anymore. By letting us handle the execution of the project the decision makers could blame us, the executors, if we made statements that were not politically desirable.*

The bilateral project organisation was supervised by a steering group. The steering group was composed by the Technical Scheldt Commission. The steering group consisted of government officials of the ministries and the province of Zeeland. The province of Zeeland participated in the steering group and had a delicate position in the constellation of actors involved in the study. The resolution of the Provinciale Staten against the deepening made it difficult for the province of Zeeland to participate in the LTV. During the process, special care was taken that the province of Zeeland would not have to commit to any agreements. For example, they did not approve the agenda and were never asked to in the first place. The province of Zeeland wanted to be a member of the steering group because the province wanted to be able to discuss the matter. It was also not an option to be a complete outsider.

The project team was chaired by the project director of the project bureau and mainly consisted of the chairpersons from the working groups and representatives of knowledge institutes. In the second phase, Cluster Morphology was added to the working groups because it was realised that morphology played an important role in the vision-making process.

An independent project bureau of policy analysts, formed by advisors of Resource Analysis from the Netherlands and Technum/ Resource Anaysis from Flanders, gave advice about the approach and handled the organisation. In this way it was possible to maintain a balance between Flemish and Dutch interests in the project. A study done by a group consisting of only Flemish policy analysts would have led to a feeling of distrust of the results by the Dutch actors involved; a study done by only Dutch policy analysts would have resulted in distrust on the Flemish side.

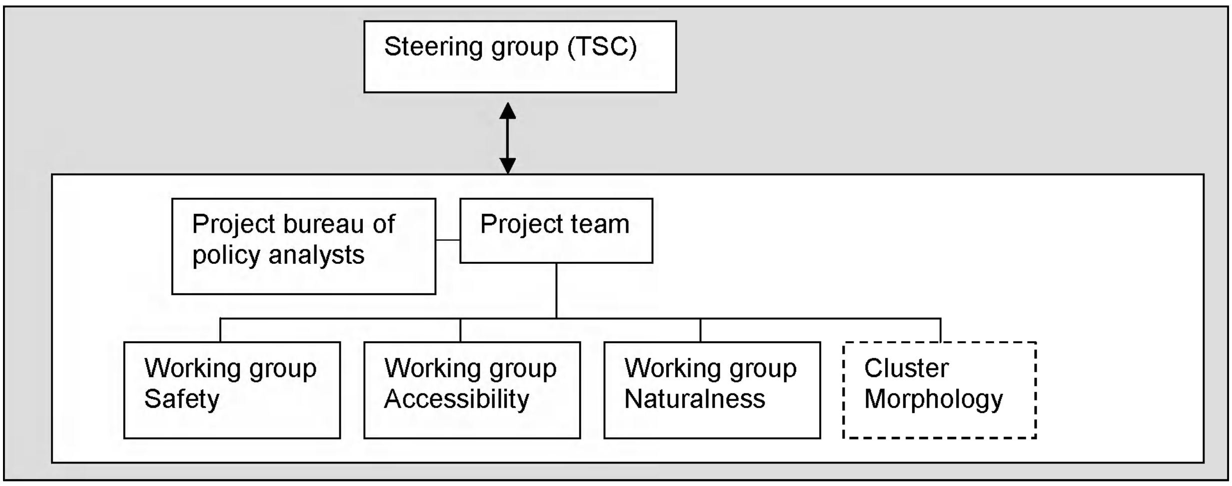


Figure 5.2: Bilateral project organization of the LTV

In Flanders, the ministries of AWZ and ANIMAL were directly and closely involved in the study. In the Netherlands, the Ministry of Transport and Water Management was represented by a delegation of the regional directorate (Zeeland). The scale at which the institutions were involved was regarded as a sign of commitment to the study. The scale difference was also perceived by the Flemish as a lack of respect. It may have been a strategic choice of the Netherlands: if the regional directorate decided on something, the Ministry could always overrule their decision.

Table 5.6: Overview of the decision making scales in the LTV

Country	Decision making scale
Belgium	Flemish Ministry was directly involved
Netherlands	Regional directorates were involved to represent the Dutch Ministry

The actors involved were categorised into the actor archetypes according to the typology described in Chapter 4 in order to aggregate their statements and to come to more general statements than those at the specific actor level.

Table 5.7: Categorisation and description of actor archetypes involved in the LTV

Actor archetype	Description
Political actor	The category of political actors is subdivided into political actors in favour of the deepening, political actors against the deepening and neutral political actors based on their own reaction. Because of their broad conflicting interests, they are expected to have a different perspective on the scale choices.
Commissioner	Technical Scheldt Commission. They delegated the study to administrative actors. The commissioner had a Dutch and a Flemish representative to maintain balance in the project.
Policy analyst	A Dutch-Flemish consortium of policy analysts (Resource Analysis and Technum).
Researcher	The category of researchers is subdivided into ecologists, morphologists and economists. These are the most important disciplines involved in the study.

5.3. Scale decision making

5.3.1. Spatial boundary setting

Actors involved

The spatial boundaries were set during the process of agenda setting. In October 1998, a workshop was organised to discuss a number of issues. One of the issues that was discussed was the spatial boundary setting. In this workshop the political actors, commissioners and policy analysts were involved. The researchers got involved in the second phase of the project (after one year) and were therefore not involved in this process.

Alternatives discussed

Previous studies on the waterway deepening issue were always conducted using the spatial boundaries of the Western Scheldt. This Western Scheldt alternative, however, was rejected right away this time for political reasons. One of the decisive arguments for looking not only at the Western Scheldt was the fierce resistance to the de-poldering in Zeeland following the previous deepening. The de-poldering was the only measure available for nature compensation when the study was limited to the Western Scheldt. So, when only the Western Scheldt was taken into account, the study would have been doomed to fail. Also, the fact that the objective was to create a long-term vision in which nature and safety would be taken into account contributed to the wish to conduct this study with wider spatial boundaries than the previous studies. A political actor talked about the start of the process:

> *When the decision was made to make a long-term vision, nobody knew how to do that. The first question that was raised was what are we talking about? Which area is discussed?*

The fact that the Western Scheldt was not really an option and the fact that the study was delegated by the Minister to the Technical Scheldt Commission (TSC) made the estuary a logical object of study. The authority of the TSC was limited to the estuary and the commission was restricted to handle technical issues in the Scheldt. In the past the TSC was also concerned with the deepening issues. So, it was clear from the beginning that the focus would be on the Scheldt Estuary. The exact location of the spatial boundaries was discussed in the workshop in which three alternatives lay on the table:

- Scheldt Estuary excluding the tributary rivers
- Scheldt Estuary including Zeebrugge
- Scheldt Estuary including the tributary rivers (for example, Rupel and Durme)

Decision-making process

Before the workshop was organised, a review was made of different options. A commissioner commented on this:

> *The policy analysts could scan how the different options were received on the other side. Of course I also discussed this directly with my Flemish counterparts, but the scan of the policy analysts gave us important additional information. From this information I could already conclude that the involvement of Zeebrugge was out of the question.*

The alternatives were discussed during the October 1998 workshop in which the arguments in favour of and against each alternative were discussed. One of the policy analysts involved was pleased that a discussion of the positives and negatives took place and that the actors present listened to each other's arguments. Three discussions played a major role during the workshop: the definition of the estuary, the inclusion or exclusion of Zeebrugge, and the inclusion or exclusion of the tributary rivers.

Discussion 1: What is the boundary of the estuary?

The first discussion was based on the fact that different definitions of an estuary exist and that the boundary location is in question and depends on the definition: is it the location where the divide between salt and fresh water is present or the location at which the tidal influence stops? An ecologist made a statement about this problem:

> *In the Scheldt there is a part of 60 kilometres with tidal influence and fresh water, s the decision on what the estuary is is quite difficult. The Scheldt has the largest fresh water tidal area since the tidal influence of the Biesbosch has decreased. We include that part in the estuary. Of course there is a close relation between the river basin and the estuary.*

So, the tidal influence determined the scale choice in this case. Also, the choice to place the boundary of the estuary at Ghent and not at Antwerp was determined by the fact that Ghent is a more natural boundary of the system because a weir is located there.

Discussion 2: Include Zeebrugge or not?
The scan that was executed during the beginning of the agenda-setting phase showed that the Port of Antwerp argued strongly against the involvement of Zeebrugge, which they considered a competitor. The Flemish government officials who were involved agreed because they considered Antwerp to be a crucial actor (economically very important and highly influencing the public opinion). Some Dutch actors regarded an expansion of Zeebrugge as an alternative to the deepening and therefore were in favour of including Zeebrugge in the study. The most important argument that was used by the Dutch to include Zeebrugge was that in an economic study of Antwerp Zeebrugge had to be included, just as Flushing and Terneuzen did. The most important argument by the Flemish was that this would be an interference by the Dutch into Flemish problems. After hearing the arguments of the Flemish the Dutch did not insist on including Zeebrugge in the study. The policy analysts reacted to the exclusion of Zeebrugge:

> *We regarded it as a pragmatic choice not to include Zeebrugge in the LTV. The Flemish were very clear about it: until here and not further.*

Discussion 3: Include the tributary rivers or not?
Some discussion on inclusion or exclusion of the tributary rivers in Flanders took place. As an argument to include them, the influence of the tributary rivers on the water quality was mentioned. The absence of sea ships on the tributary rivers was an important aspect of the argument, leading to the decision to exclude them from the study. By excluding the rivers, it was also possible to keep the regional stakeholders out of the study. In the long-term vision, the water systems that are managed by the national governments are considered most important. The regional water systems have an influence but are considered external factors within this project (Ministerie Verkeer en Waterstaat, 2001b).

At the end of the workshop one of the policy analysts made a proposal for scale choices based on a discussion during the workshop. He suggested that they were going to work out a plan that excluded Zeebrugge and the tributary rivers. The actors in favour of including Zeebrugge recognised that these factors played a crucial role and agreed with the selection of the *estuary only* alternative. A policy analyst concluded:

> *The boundary setting had to be done in a pragmatic way. We needed to make sure that we could create a coherent vision without having to deal with a lot of unnecessary ballast. That does not coincide with the ideal image, but we had to make a pragmatic choice in a context in which a lot of actors distrusted each other.*

Selected spatial boundaries: Scheldt Estuary excluding the tributary rivers
The selected spatial boundary of the project was defined as the Scheldt Estuary from Ghent to the North Sea, including the banks and the mouth, excluding the tributary rivers and channels. The inclusion of the mouth of the estuary (including Zwin, an area near Knokke), although seemingly a minor detail, could also be regarded as a catalyst in the process. The agreements on the Zwin had already been reached, and the results could be taken into account in the LTV-study without any discussion. A political actor explained:

> *The Zwin is a nature conservation area which belongs to the Netherlands for 25 % and to Flanders for 75 %. Zwin has been a subject of discussion between Flanders and the*

> *Netherlands for many years. Especially how the silting processes can be counteracted. Joint actions to improve the Zwin have already been taken. A number of actions are also taken into account in the LTV.*

A lot of attention was paid to the arguments that led to this spatial boundary setting in the reports. An important criterion to limit the spatial boundaries of the study was the ability to formulate a coherent integrated vision for the Scheldt Estuary (Ministerie van Verkeer en Waterstaat et al., 2001a). The choice not to include the tributary rivers and channels was made in order to limit the number of governments involved in the process. The reason to include Ghent (and not to set the boundary at Antwerp, which is located downstream) is that in this way the entire tidal area is taken into account (Ministerie van Verkeer en Waterstaat et al., 2001b).

It was stressed that the spatial boundaries were not intended to be fixed. If a theme required different spatial boundaries, it was possible to adjust them. A political actor reflected on this flexibility:

> *I think the spatial boundaries have to be handled in a flexible way and may be changed depending on whether the safety naturalness or accessibility is under study. This is exactly what happened in the study. The spatial boundary setting is quite flexible. In our opinion questions need to be asked continuously about the boundary setting. Does it have an added value to take an area into account? Does it influence the situation? If it has influence we do not have arguments not to take it into account. It is difficult to set fixed rules beforehand. I think the flexibility has a very positive effect on the management of the dossier and on the relation with the Netherlands.*

The selection of the spatial boundaries was controversial in this study, because conflicting preferences were present and the spatial boundaries had important consequences for the position of the Port of Antwerp. In the interviews, it appeared that most actors had very clear preferences. One of the political actors seemed not to care very much which spatial boundaries were selected as long as they were sufficiently represented:

> *We did not mind very much which spatial boundaries were going to be selected. We operate at different levels, both the river basin in the ICBS and the Western Scheldt in the Governmental Platform Western Scheldt. We just looked whether we were sufficiently represented.*

Although some actors preferred a different spatial scale, nobody seemed really unhappy with the final selection. The actors involved, except for the Port of Antwerp, clearly did not think the effects to be critical. The policy analysts considered it a big step that it had been possible to scale the problem up from the Western Scheldt to the Scheldt Estuary. A policy analyst mentioned this:

> *As an analyst I thought it was one of the largest steps made that we could discuss the Scheldt Estuary instead of only the Western Scheldt. The two countries admitted that they were going to talk together about each others territory, which created a balance because the Flemish were not only going to talk about Dutch territory, but the Dutch were going to talk about a small part of the Flemish territory as well.*

Another policy analyst put the importance of the spatial boundary setting into perspective:

> *No matter what spatial boundaries would have been chosen the deepening would always have been a key issue in the LTV because it was the deepening that induced the study in the first place. The only option not to place the deepening central on the agenda is to include*

> *Zeebrugge and maybe even Rotterdam into the study, but this was really not an option because of the competition positions.*

The dominating rationality in the decision was the political rationality. It may seem that the managerial rationality also played an important role because the spatial boundary setting because the time constraints also played an important role. The available time issue was, however, politically loaded. A number of factors seemed to be determining this spatial boundary setting: the willingness to cooperate, the available time, the autonomy of states, and the focus on the agenda. The selection of the spatial boundaries was thought to be essential to involving all relevant stakeholders in the study: the willingness to cooperate was dependent on the selection of the boundaries. The only way to get the Port of Antwerp to cooperate was to exclude the other ports, like Zeebrugge, Oostende and Rotterdam, from the process.
The Flemish had an urgent interest at stake here: it was in their interest that this study be finished as soon as possible so that a fast decision on the deepening could be made. This was one of the reasons to limit the timeframe of the study and it forced the need for focus on the agenda. The amount of time available for the execution of the project also played an important role in the exclusion of the tributary rivers and Zeebrugge, and in the wish not to involve too many stakeholders.

Major dilemmas
The discussion on the spatial boundaries concentrated mainly on the inclusion or exclusion of Zeebrugge. In line with van Twist et al. (1998), tension bows were used to visualise the trade-offs that needed to be made in the LTV (for an explanation of the tensions bow diagrams see also Section 4.5.3). Because actual discussion on spatial scales concentrated mainly on the inclusion or exclusion of Zeebrugge the tension bow is constructed for these two alternatives. In retrospect, the following dilemmas can be identified:

Efficiency versus high overall utility
By selecting the *estuary only* alternative, the agenda remained focused, which led to efficiency, manageability and feasibility. Focusing the agenda is considered important for a number of reasons. One of the reasons is that the homogeneity of actors was better because the internal Flemish tensions between Zeebrugge and Antwerp were left out of the study. Also, a focused agenda contributed to finishing on time. By including Zeebrugge, a large variety of options would have been put on the agenda, so the potential overall utility might have become larger. By including Zeebrugge, the risk of premature closure would have been reduced, so it would have contributed to the *design and recommend* activity in the hexagon model.

Recognition of sovereignty versus legal validity
By selecting the *estuary only* alternative, the sovereignty and autonomy of the states remained guaranteed. By including Zeebrugge, the Dutch would have had a say in Flemish issues, such as the relationship between Antwerp and Zeebrugge. The Flemish thought this to be an internal affair in which the Dutch did not need to be involved. By including Zeebrugge, the legal validity would have increased because, according to the Habitat Directive, alternatives for proposed measures have to be studied.

Willingness to cooperate versus openness
By selecting the *estuary only* alternative the willingness to cooperate was ensured: Antwerp would not want to cooperate if Zeebrugge were included. By including Zeebrugge, the process would have been open to actors and to additional issues that were not directly related to the deepening. For example, safety issues in the coastal zone area could have been

included. Also, other actors besides Antwerp, with an interest in the deepening, such as Zeebrugge, could be involved.

Based on these issues, a tension bow was constructed that is displayed in Figure 5.3.

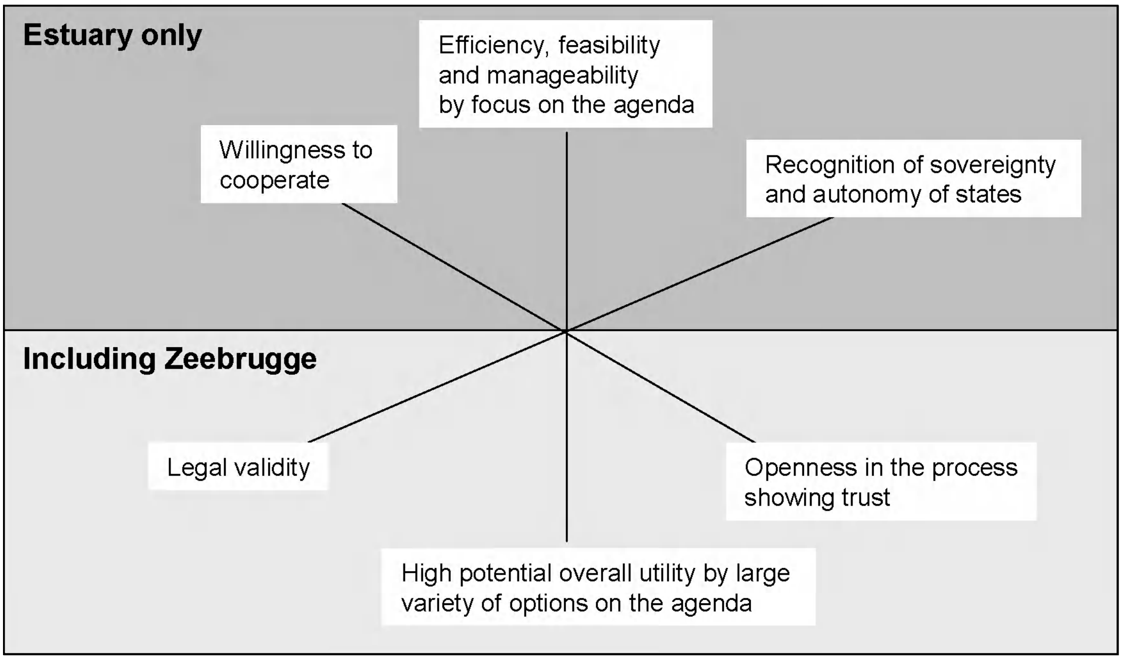


Figure 5.3: Tension bow diagram for the spatial boundary setting in the LTV from the perspective of the policy analyst

5.3.2. Temporal boundary setting

Actors involved
The temporal boundary setting also took place during the process of agenda setting, during the same workshop that the spatial boundary setting was discussed. Therefore, the political actors, commissioners and policy analysts were also involved in the temporal boundary setting.

Alternatives discussed
Long term is always quite a vague and broad notion. The question about what was considered to be long term was quickly raised. The year 2050 was not discussed in detail; only a few actors involved were in favour of 2050 as the long-term end point. It was quickly put aside because it was not politically useful. Another reason not to select 2050 was that more uncertainties would play a role, for example climate change would become an important factor. In the decision-making process, therefore, two options were lain on the table:

- 2010: preferred by the Flemish because of the urgent issue at stake
- 2030: preferred by the Dutch to make it possible for a real long-term vision that also included environmental concerns

Decision-making process
On the institutional level, different preferences existed between Flanders and the Netherlands which can also be explained by cultural differences. The Flemish policy makers were at that time not used to working with large temporal boundaries. For the Flemish, 2010 was considered to be quite a long term, so in the beginning they thought that 2010 would be

sufficient. The Dutch thought that 2030 was a more suitable temporal boundary because this date fit with other long-term planning projects in the Netherlands. The year 2030 was, for example, when the perspective of the 4th Policy Paper on Spatial Planning would be due. Also, for other water management projects, 2030 was selected for the creation of a long-term vision.

The Port of Antwerp was especially in favour of a shorter temporal boundary than 2030. For them, it was important to have a specific result upon which action could be taken quickly. The year 2005 was regarded by the Flemish as the year the deepening would have taken place. They wanted to make agreements of what should be realised in 2010. The Dutch regarded 2010 as short term; according to the Dutch, 2010 would be the date by which a few initial things would be realised. The Netherlands preferred a sound inventory of the problems and wanted to take into account the effects on the ecological system. Therefore, the term for finding solutions had to be more than 10 years.

This difference of opinion could easily have evolved into a conflict. Although different opinions were present, not much time was actually needed to reach a decision on the temporal boundary setting because of the intervention of the policy analysts. The policy analysts tried to close the gap between the Flemish and the Dutch by proposing a methodology to work with differentiated time scales (2005, 2010, and 2030).

Selected temporal boundaries: 2030 (2005/2010 also taken into account)
Finally, 2030 was selected as the end date for the long-term vision. It was decided to work on a long-term vision for 2030 based on a short-term situation sketch from 2005 (see Figure 5.4). The target of 2030 as the long term was always central but the question was how to reach this target. Backcasting could be used to develop policy options for the middle to long term (development sketch). Four development sketches were created for 2010 that contained policy options to reach the long-term vision. The idea was to make agreements for what would have to be done by 2010 to be able to reach the desired goal by 2030. The year 2005 was selected as the current status because this would also make it possible to avoid discussion about conflicts that were playing out at the time of the study.
One of the reasons mentioned in the report for selecting this approach was that it met the different views of what was considered to be long term (Ministerie van Verkeer en Waterstaat et al., 2001b). The situation on the short term was used to be able to get a little distance from the current situation.

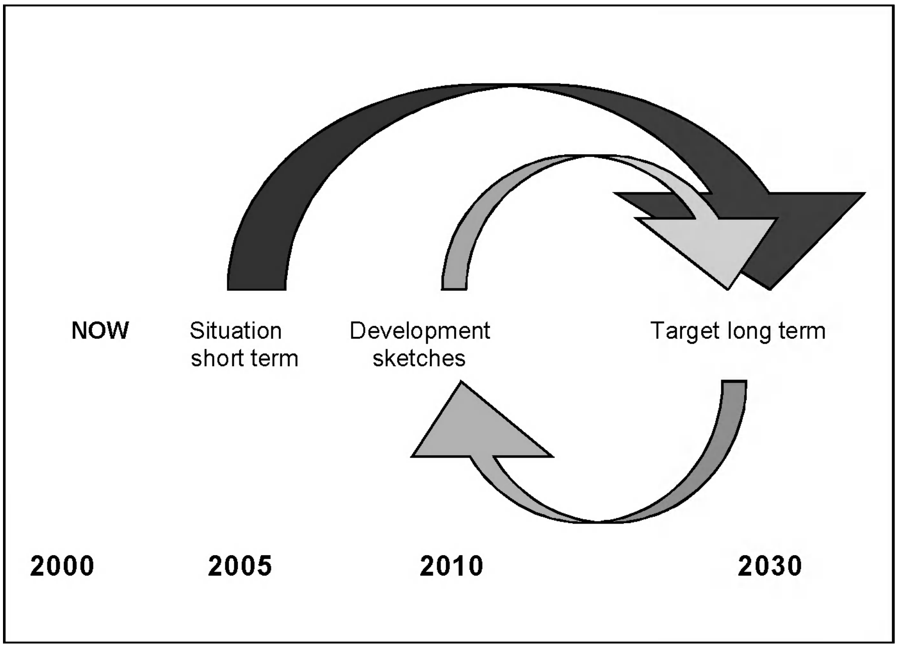


Figure 5.4: Combining the short term and long term (Source: Ministerie van Verkeer en Waterstaat, 2001a)

A policy analyst noted:

> *2030 is far away. We have gone to the limits of our possibilities. I do not think that the result would have been very different if we had selected a wider temporal boundary. The temporal boundary has been set arbitrarily; there is no real sound argument for it. A question that was frequently asked in the trade-off was: is it far enough to formulate our goals and is it not too far to be wrong about our goals?*

Major dilemmas

The discussion about time scale focused on 2010 versus 2030. With van Twist et al. (1998) in mind, tension bows were used to visualise the trade-offs that needed to be made in the temporal boundary setting in the LTV (for an explanation of the tensions bow diagrams see also Section 4.5.3). In retrospect, the following dilemmas can be identified:

Serving ecological concerns versus economic concerns

Long-term and short-term interests can conflict. By selecting 2030, the ecological concerns will be better served, because long-term effects can be included. For the Netherlands the ecological concerns played an important role because the fear existed that the deepening would have negative effects on the estuary's ecosystem. The economic concerns would, however, have a less prominent place on the agenda. By selecting 2010, the economic concerns will be better served because the Port of Antwerp needs to deepen its waterway in the short term, otherwise it will lose its competitive position. The ecological concerns are not served by selecting 2010 because many effects on the ecosystem only become visible over the long term.

Broad range of options preservation naturalness of the system versus action ability

By selecting 2030, a broad range of options related to the preservation of the natural system becomes available, making room for optimisation. For 2010, the action ability is larger because results are needed in the short term. The range of options for 2010 is limited to measures that can be implemented in the short term and have fast results.

Possibilities for consensus building versus sense of urgency
For 2030 the possibilities for consensus building are more plentiful because it is easier to overcome and address differences of opinion when discussing the long term. On the other hand, by selecting 2010 the sense of urgency increases, probably leading to a faster decision on the urgent issue of deepening. A fast deepening of the Western Scheldt was crucial for the development of Antwerp and the Flemish economy.

Ambitious, far-reaching vision versus tangible, overseeable vision
By 2030, an ambitious, far-reaching vision can be created. The Dutch policy makers were in favour of such a vision because the issue of the deepening was returning to the agenda and had to be solved on a more permanent base. An argument against this alternative is, however, that the vision will be rather abstract and perhaps even vague because it is difficult to see so far ahead. For 2010 a tangible and overseeable vision can be created. However, it will not be ambitious because it is more 'business as usual'.

In Figure 5.5 the tension bows for the temporal boundary setting are visualised in a diagram.

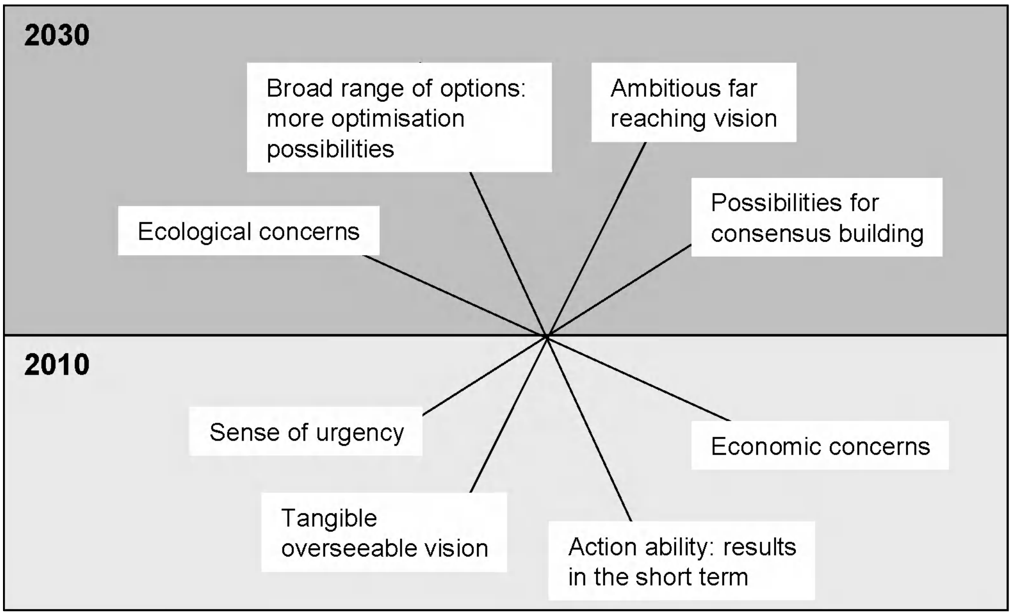


Figure 5.5: Tension bow diagram for the temporal boundary setting in the LTV from the perspective of the policy analyst

5.3.3. Selection of the level of aggregation

Actors involved
The boundary conditions for the level of aggregation were set by the political actors, commissioners and policy analysts at the beginning of the study. The selection of the level of aggregation appeared to be an on-going activity over the entire study. Therefore, all actors involved in the study were repeatedly involved in the selection of the level of aggregation.

Alternatives

The selection of the level of aggregation is quite difficult to conceptualise. Of course, in a simplified way, it is possible to say that two alternatives lay on the table: a low level of aggregation and a high level of aggregation.

Decision-making process

The discussion on the level of aggregation did not take place often on this abstract level, but was considered to be very situation specific: it involved specific details that were to be included or excluded and played a continuous role throughout the study. The level of aggregation generated little discussion; it was not a separate item of discussion at the beginning. At first, it was decided to see what management problems needed to be resolved. This activity played a leading role in the selection of the level of aggregation. It quickly became clear that, based on management problems, lots of details needed to be included and led to many problems. At that point, the selection of the level of aggregation became a subject of discussion. A more pragmatic approach was chosen in which a high level of aggregation was selected as a starting point. The idea was that, to be able to create a vision, a high abstract level was needed. Another reason for the selection of a high level of aggregation was that this study was performed in the early stage of the decision-making process. Also, the limited time frame of the study (the study had to be finished in two years' time) made it impossible to study all the aspects in great detail. A high level of aggregation was thought to contribute to the stimulation of joint collaboration between the governments of Belgium and the Netherlands because conflicts might be prevented. Box 5.1 and 5.2 provide examples of the selection of a high level of aggregation.

Box 5.1: Safety issue: an example of a high level of aggregation
In the Netherlands not many problems were expected about the safety issue, so a high level of aggregation would be sufficient. In Flanders, however, safety was considered to be a big problem. Another study, the Sigma plan, had already started to address the safety problem. In the Sigma plan, a low level of aggregation was used. Therefore, it was not considered necessary in the LTV to work with so many details and a high level of aggregation was selected for this issue. Alternative options were studied globally, like should space for the rivers be created? Should a surge barrier be constructed?

Box 5.2: Prognoses economic situation: an example of a high level of aggregation
Three very generic economic prognoses were used for 2020 and called global competition, divided Europe, and European coordination. These scenarios comprised the entire Hamburg-Le Havre range. Considering this large scale, the prognoses had a resolution of several hundreds of square kilometres.

A political actor against the deepening noted that no other options but a high level of aggregation were available:

> *The LTV is by a lot of people considered to be quite vague on a number of points, but you can not expect a detailed vision for 2030. I think that the work has been done on a level of aggregation that was feasible. For a low level of aggregation was no space within the selected field of forces and the amount of time available.*

Wherever a detail was needed for decision making, it was optional to go into more detail. It was agreed upon that the question always had to be asked whether a detail was worth taking into account at that moment or not. It was also agreed that the details could be worked out at a later stage in the Strategic Environmental Assessment study. Box 5.3 provides an example of a subject that was studied on a low level of aggregation.

Box 5.3: Shipping: an example of a low level of aggregation
For the accessibility of the Port of Antwerp many details were studied because this was the basic problem that led to the start of the Long-Term Vision. Detailed information on shipping types, movements, ports and navigational depths were involved in the analysis. For the LTV, mainly available information was collected from different previous research. A lot of data with a resolution of less than a square kilometre was available on this matter and this was taken into account.

Selected level of aggregation: various levels
The starting point was to work at a high level of aggregation because this was thought to best fit with a long-term vision. The selected level of aggregation was not made explicit in the study reports. As a starting point, a high level of aggregation was selected. The goals of the LTV for 2030 were formulated on a very general and abstract level because of the long prediction period. It was considered very difficult, if not impossible, to make specific and detailed statements for that term. The selection of different temporal boundaries to be included in the report also introduced different levels of aggregation.

Major dilemmas
In the process of an on-going selection of a level of aggregation, the trade-off of whether to go into detail or not was made continuously throughout the entire project. For each subject a new trade-off was made. Based on van Twist et al. (1998), tension bows were used to visualise the trade-offs that needed to be made continuously regarding the level of aggregation in the LTV (for an explanation of the tensions bow diagrams see also Section 4.5.3). In retrospect, the following dilemmas can be identified:

Big picture versus profound study
With a high level of aggregation, it is easier to maintain an overview of important issues. At a low level of aggregation, the big picture might be a distraction and one could get lost in the details. On the other hand, with the selection of a low level of aggregation, it is possible to conduct a more profound study that goes further than shallow observations and obvious truths.

Need for cooperation versus possibilities for issue trade-offs
With the selection of a high level of aggregation, the need for cooperation is recognised because nobody has the complete picture and the coherence of the issues plays an important role. When a low level of aggregation is selected, the study is likely to be split into pieces, because it would take too much time to use an integrated approach when a lot of details are needed. Splitting contributes to the manageability of the study.

General political agenda versus recognition of actors' interests
A high level of aggregation serves the general political agenda because the coherence of issues remains central. The actors' responsibilities and interests, however, may be better recognised and protected when working on a low level of aggregation, whereas on a high level of aggregation these are sometimes ignored. Sometimes, details may be needed for the decision making.

Secure progress by prevention of conflicts over the details on the short term versus secure progress by creating opportunities for issue trade-offs and long-term progress
Selecting a high level of aggregation often makes it easier to build consensus between the actors involved because conflicts over the details may be prevented. In this way, the progress of the study may be secured. It also explains why a high level of aggregation is often less time consuming. A low level of aggregation, however, provides more opportunities for issue trade-offs between actors on the details. A low level of aggregation would also contribute to addressing and solving conflicts for once and for all. When looking at long-term progress, this might be preferable.

Match with long term versus match with short term
It was considered very difficult, if not impossible, to make specific and detailed statements over the long term due to numerous uncertainties. For a short-term project it is possible to make more detailed statements.

In Figure 5.6 the tension bow diagram for the selection of level of aggregation is displayed.

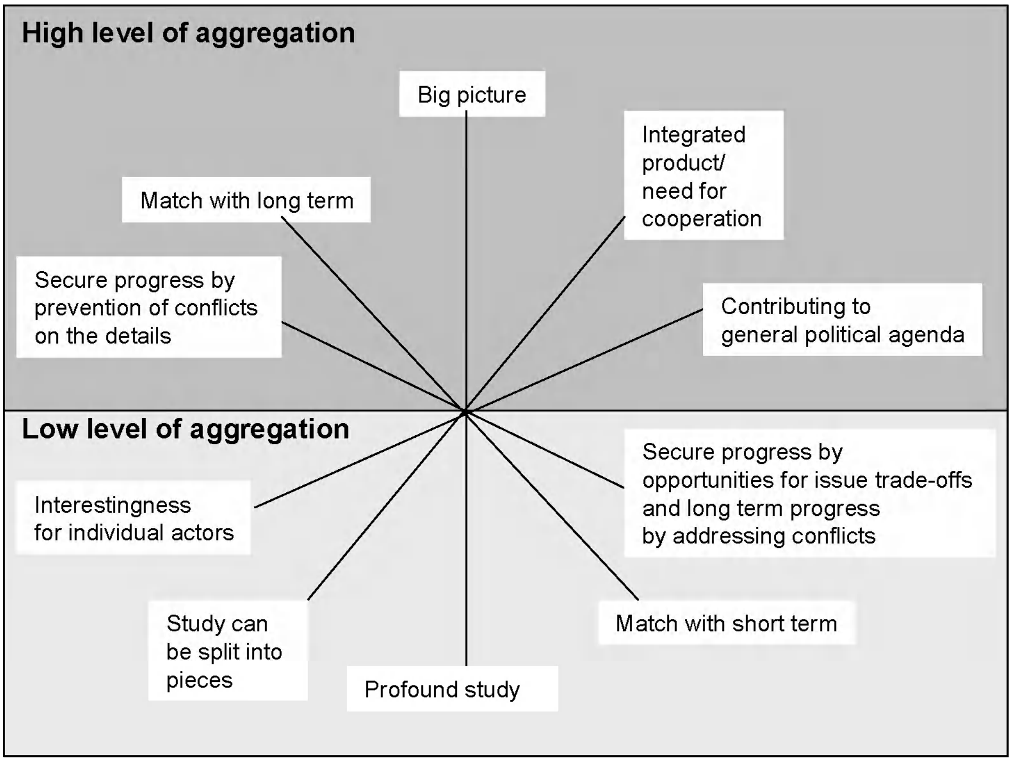


Figure 5.6: Tension bow diagram for the selection of the level of aggregation in the LTV from the perspective of the policy analyst

5.4. Scale handling during the process

In the LTV, a general distinction can be made between three scale-related rounds. For both the spatial and temporal boundary settings, similar rounds can be identified. An overview is provided in Table 5.8. The selection of the level of aggregation does not fit into this rounds model because it was a continuous matter for consideration during the study and it depended strongly on the subject under consideration.

Round I: Agenda setting

The first round that can be identified is the agenda setting in which the scale choices were made by the policy makers, and in which the multi-stakeholder perspectives on scale prevailed. The first round was discussed in the previous section. In the second round, the spatial and temporal scale choices were adjusted in the scientific studies by the researchers as explained below and in the third round all the information on the different scales had to be integrated by the policy analysts.

Round II: Scientific studies

The second round consisted of the scientific studies in which options were reviewed and impacts were assessed. The initially selected spatial and temporal boundaries were not adopted in the scientific studies; new choices were made and in each scientific study other choices were made. In the scientific studies, other spatial and temporal boundaries were used because the researchers argued that they could not say anything on that spatial or temporal boundary. They said they had to use other boundaries in order to be able to conduct scientifically valid studies. In this second round, at which point the researchers got involved, the multi-disciplinary perspectives dominated. For each discipline, different adjustments were made. This provides a logical explanation for the difference in scale choices made. The researchers adjusted the spatial and the temporal boundaries in order to contribute to the validity of the study. A policy analyst stated:

> *During the study, the temporal boundary turned out to be a very difficult issue. In the beginning we were working with three temporal boundaries: 2005, 2010 and 2030. Then it was a very clear story based on governmental relevance. After about a year, in the second phase of the study, the researchers got involved and new temporal boundaries appeared that were more scientifically based. In the specific research, questions were asked like: what is a relevant ecological temporal boundary? What is the relevant morphological temporal boundary?*

For the study on economy, broader spatial boundaries were selected to be able to study the economic processes. The competitive position was an important subject of study at that point. To be able to study the competitive position, all relevant ports that were in competition with the Scheldt ports had to be included. The selected spatial boundary, therefore, was the Hamburg-Le Havre range. In the economic studies, 2020 was used as a temporal horizon because of the availability of prognoses, and it was thought a useful time horizon to calculate a return on investment.

For the study on naturalness, the spatial boundaries were basically copied from the main study, with some small additions. A small part of the tributary rivers was included in order to place the boundary at the location where the tidal influence stopped. Also, the upstream part of the river basin was taken into account as a separate zone for which measures were formulated (de Eckere et al., 2001). For the study on naturalness, no temporal boundary at all was selected because the ecologists wanted to couple the issue apart from the fixed temporal boundaries and disregarded using temporal boundaries entirely. They think it is more important to look for trends and in terms of extrapolating a line towards the future. They consider it very important that the Scheldt is a dynamic system and has no fixed temporal boundaries; they prefer to look at trends. An ecologist explained it as follows:

> *We do not work with these kinds of temporal boundaries, we look at trends not at fixed moments in time. 2010, 2030 and 2050 are typically distinctions for policy makers. As ecologists we look more for trends and in terms of a line towards the future, therefore we do not mind whether it is 2010, 2030 or 2050, we always extrapolate the line, so it is always the same line that is involved. We can set goals like so much percentage of the water needs to be*

> *treated before entering the river by the year… of course. What do we want to achieve at a certain time is a typical policy phrase. Should we say how many fish swim in the Scheldt when? That is impossible. We would like to show how to go forward and look at the situation step by step. We are going to study the influence of the improving water quality. In Brussels a large water cleaning plant has been built so the water quality of the Rupel will improve. That kind of question is interesting for us, and no specific term is coupled to these questions.*

The study on morphology mainly focused on the Western Scheldt because the multi-channel system is confined to Western Scheldt. The temporal boundary set for the study on morphology was, in principal, 30 years, but also 50 years was sometimes used. The morphologists made the temporal boundary an issue for discussion. The morphologists introduced the micro-, meso-, macro- and mega-temporal boundaries in discussion with the other actors in the study. These temporal boundaries were used by the researchers to discuss the issues, instead of the year 2030.

In the beginning of the process, it was decided that the boundaries would be handled in a flexible way. This flexibility was also used during the design of policy options in which small changes were occasionally made. Two examples of upscaling are described here:

- *Make a connection between the Eastern Scheldt and the Western Scheldt:* One of the major problems playing out during the study was finding areas for nature conservation within the selected spatial boundaries of the study. Re-establishing the connection between the Eastern Scheldt and the Western Scheldt would contribute to the safety and be an effective way to create a nature conservatory: in the Eastern Scheldt area enough space is present for it. Although the connection falls outside the Scheldt Estuary and the area is not under the authority of the actors involved in the study, this was still included as an option. The establishment of a connection would, however, have major (negative) effects on the water quality of the Eastern Scheldt, so it was a rather controversial option that was removed from the agenda in the follow-up.
- *Dump sediment outside the Scheldt Estuary:* A policy option that was suggested for the morphological management was to dump sediment outside the Scheldt Estuary. Dumping sediment in the estuary of the Scheldt itself had to be balanced with the risks of disturbing the desired dynamics of the morphological system.

The examples show that upscaling is an interesting option if a solution for a problem cannot be found within the selected spatial boundaries.

Round III: Integration of information in the LTV

The third scale-related round consisted of the integration by the policy analysts of all the information on the different scales. The policy analysts put out a lot of effort to integrate all the information; especially the information that was based on different temporal boundaries was perceived to be difficult to integrate. The mismatch between selected spatial and temporal boundaries and scientific perspectives led to adjustment needs and integration difficulties for the analysts in the end. One of the analysts reacted with the following about the changes in the temporal boundaries:

> *I would have preferred to stick to 2010 and 2030. Then it was a very clear story. We finally agreed with the other perspectives, because otherwise we would not have received an answer at all. Also information of the Sigma plan had to be used in which 2015 and 2050 were selected, so again different time scales. Therefore, it was difficult to maintain the earlier selected temporal boundaries. In the end you work with so many temporal boundaries which made it quite confusing.*

Table 5.8: The LTV in spatial and temporal scale-related rounds

Spatial scale related rounds	Description	Date
I: Agenda setting	Political actors constructed an agenda and decided on the scale choices. The scale choices were politically loaded.	March 1998-March 1999
II: Scientific studies	The researchers did not agree with the scale choices made and switched to choices that fit more with their discipline	March 1999-December 2000
III: Integration of information in LTV	Policy analysts had to integrate all information from different scales into one vision	January 2001-February 2001

5.5. Results

The policy analysts managed to deal with the many political caveats hidden beneath the agreement on the objectives of the study and completed the study in time and to the satisfaction of all actors involved in the project. The study resulted in an increase in trust between Flanders and the Netherlands. One of the substantial qualities of the project was that the visions from the researchers got a place in the policy process. For example, the morphologists' multi-channel system concept got a lot of attention, and all actors involved were convinced that to maintain the multi-channel system was a key issue for the deepening. An important general conclusion was that space must be present for a variety in dynamics because these are essential for the morphological and natural characteristics of the estuary.

Multi-channel system is an important characteristic and can be preserved
The Scheldt Estuary is one of the few multi-channel system estuaries. In the morphological study, it was concluded that the preservation of the multi-channel system was the key issue. The choice to maintain this system was thought to have effects on the management of the estuary. No limitations for the deepening were to be expected but strict limitations were present for the sediment dumping strategy. Dumping the sediment that was dredged during the deepening activities was not possible within the system because of the risks of disturbing the dynamics of the system.
The morphology study played an important role in the process of consensus building. The maintenance of the multi-channel system was one of the first issues over which consensus was reached. A lot of policy makers were at first hesitating about the deepening because of the uncertainties of the morphological effects on the estuary. When it became clear that the deepening would have no major effect on the morphology, it removed a major obstacle in the process (from WL Delft Hydraulics, 2001 and pers. com. Winterwerp, August 2004).

Antwerp is the only port to benefit from the deepening
Antwerp would be the only port in the Scheldt Estuary to benefit from the deepening of the waterway. In the economic study, a deepening to 14 metres was advised, instead of the 13 metres that was finally agreed upon. Ghent mainly handles bulk material ships, and not many container ships. The limited depth of the sea sluices and the (English) Channel from Ghent to Terneuzen were considered to be larger barriers for Ghent than the lack of depth of the Scheldt Estuary. Flushing could already handle ships with a nautical depth of almost 13 metres because it is so close to the sea. The economic study also showed that Zeebrugge was not an alternative unless large investments would be made in hinterland transport facilities; therefore; Zeebrugge would always be more expensive for shipping companies. Then,

shipping companies would go to Rotterdam instead because the transport facilities are much better (from Policy Research Corporation, 2000 and pers.com. De Monie, March 2005). The economic study also concluded that, within the Hamburg-Le Havre range, port expansion possibilities were limited because of the general lack of capacity within the ports in the Hamburg-Le Havre range and the stricter environmental regulations for port development.

Preservation of estuarine gradient, variety in dynamics and improvement of water quality
The estuarine gradient must be preserved because the Scheldt Estuary is one of the last estuaries in Europe in which a full gradient from salt to fresh tidal area is present because of the large size of the estuary. As stated earlier, the deepening probably leads to an increase in current velocity resulting in a higher dynamics. According to the ecologists' study, the dynamics are already too high for the ecological system because the shallow and calm areas are eroding away and banks are getting steeper. Ecologists would prefer a variety of dynamics: the depth does not matter very much as long as there are sufficient shallow spots available with low dynamics. For the port, high dynamics is also not beneficial because more dredging would be needed. The port prefers deep but quiet water. In a dynamic situation more dredging needs to take place, creating an unfavourable position for the port. This increase in current velocity can be compensated for by creating more shallow areas near the shore to dissipate the energy. This shows the close coupling between the deepening and nature conservation. A solution for this would be to give space to the river by using polders to create these shallow areas (after Deckere et al., 2001 and pers. com. Van Damme, September 2004). One of the important requirements in order to realise a healthy ecosystem for the Scheldt Estuary is the improvement of the water quality by reducing the number of contaminants. The water quality is still a limiting factor for the quality of the ecosystem, for example for biodiversity. The water quality can only be improved if less organic material and fewer nutrients are discharged in the entire river basin of the Scheldt (after Deckere et al., 2001 and pers. com. Van Damme, September 2004).

5.6. Aftermath

General aspects
The LTV mainly focused on the problem analysis and the design of options. The Flemish and Dutch governments ratified the estuary's Long-Term Vision, prescribing the conduct of a societal cost-benefit analysis and a strategic impact assessment to explore the options and the effects more closely. After the ratification of the study, a follow-up process was started. This follow-up study was called the Development Sketch 2010 in which options were designed in more detail. The effects were studied more closely in a Strategic Environmental Impact Assessment (SEIA). In this impact assessment study, the researchers played a more important role and were more closely involved in the making of scale choices. In the follow up, the policy analysts positioned themselves closer to the researchers.

In March 2005, the decision was made to proceed with the deepening. It became clear that, although issue trade-offs within the study were limited, other issue trade-offs beyond the scope of this project had played a large role in the decision-making process. The decision to deepen was taken simultaneously with a number of other decisions that were intended to compensate the Dutch for the deepening. The Flemish signed a treaty with the Dutch in which they agreed to the route of the High Speed Railway track in Belgium by which they had not a lot to gain. The province of Zeeland was compensated with a package of infrastructural measures. Also, the promise was made to study the possibilities of the deepening of the Channel from Ghent to Terneuzen. Nature compensation measures in Flanders and in the Netherlands were part of the agreement.

This was however not the end of the story. The de-poldering of the Dutch part of the Hedwigepolder, as part of the nature compensation met a lot of resistance among the inhabitants of Zeeland. The Dutch Ministry of Agriculture, Nature and Fishery decided therefore in April of 2009 to use a far more expensive alternative for the nature compensation: the creation of salt marshes. The Flemish were asked to contribute in the extra costs, but refused because they considered it a problem of the Dutch.

In July 2009, the Dutch Council of States *(Raad van State)* made the provisional decision that they did not allow the deepening of the navigation channel of the Western Scheldt because they thought it was unclear what the effects on the naturalness are in the Western Scheldt and in Saeftinghe. The decision was based on a legal procedure that was started by a number of environmental organisations that objected against the deepening. The definitive decision is made in December 2009, after the printing of this thesis.

Reconsideration of scale choices
In the follow-up phase, the scale choices were reconsidered and resulted in new choices, which are discussed below.

Extension of spatial boundaries: inclusion of Zeebrugge
In the SEIA, the spatial boundaries were adjusted in such a way that Zeebrugge was included. The SEIA was not only more scientifically oriented, it also had to adhere to the legal procedures and requirements for environmental impact assessments. An important legal framework in this respect was the Habitats Directive. This directive calls for compensation if important nature areas are negatively influenced. According to the Habitats Directive, alternatives for proposed measures have to be studied. Expansion of Zeebrugge could provide an alternative to the deepening and, as such, needed to be studied more closely. The legal validity of the SEIA under the Habitats Directive would have decreased if this alternative had not been taken into account. Also, the involvement of Zeebrugge in this follow-up study was no longer considered a sensitive issue. All actors involved realised at this point that the extension to Zeebrugge would not provide a solution for the container transport problem because of the lack of hinterland connections, so it was no longer regarded as a serious alternative. Also the trust had grown. The Port of Antwerp, therefore, did not feel threatened by the fact that Zeebrugge was being reconsidered at this stage, and there was no fear that the Dutch would come to have a say in internal Flemish issues.

The exclusion of Zeebrugge in the LTV and the inclusion of Zeebrugge in the SEIA are indicative of the differences in orientation of the two studies. While the LTV had a large political character and fulfilled a mediating objective in the context of a lot of distrust between the Netherlands and Belgium, the SEIA was more research oriented.

Some Flemish actors in favour of limiting the spatial boundaries of the Scheldt Estuary at the beginning of the LTV admitted, when looking back, that involving Zeebrugge or the Channel from Ghent to Terneuzen might also have had some advantages:

> *At that moment I did not feel the necessity to involve Zeebrugge. Now, a few years later seeing the possibilities of the Long-Term Vision and the larger readiness to active participation I think it might have been useful.*

> *Looking back, I think it is obliviousness on the Flemish side not to include the Channel from Ghent to Terneuzen. The Channel from Ghent to Terneuzen contains one of the busiest sluices in Europe and is therefore not always very accessible to the ships. So, there is also reason enough to strive to cooperation. I do not exclude the possibility of an agreement between Belgium and the Netherlands to take the Channel into account in the follow-up. Maybe we can apply the same principles as in the Scheldt Estuary for cooperation on the Channel from Ghent to Terneuzen.*

The reactions indicate the trust had grown during the process.

Request by regional actors for larger spatial scale in the assessment of effects
After the study had finished the regional stakeholders asked for upscaling in the assessment of effects. During a consultation meeting, the stakeholders discussed the boundary setting of the impact assessment project. Especially in the assessment of the effects of the plans they felt that the selected spatial scale was not satisfying because the negative effects on their interests were not included.

- The farmers made a plea to take the land surrounding the Scheldt Estuary into account in the assessment of effects, because a lot of measures were being suggested for nature that might also negatively influence the agricultural land surrounding the estuary. They were afraid that the plans would lead to more salt in the groundwater which would have negative effects on the agriculture.
- The tourism industry in Walcheren (Zeeland) wanted to take into account the effects of the deepening near the shoreline of Walcheren. Their argument was that Walcheren's shoreline is also part of the mouth of the Scheldt and should therefore be included in the study. They stated that after the second deepening the current flow had increased, which had a negative effect on recreation. Also, they were worried about the quality of the beaches when near shore dredged material from the deepening was deposited. This dredged material was thought to contain a lot of silt, which might not be dirty but certainly would look dirty.
- The municipalities in Zeeland wanted to know what the risks were for the caving in of the shoreline caused by the faster current flows.

Smaller and larger temporal boundaries in the follow-up
The LTV had shown that it was important to be able to take the impacts of the long term into account because some effects occur immediately after the realisation of the plan and do not change afterwards, while other effects become visible or measurable in the long term. The temporal boundaries were reconsidered for the impact assessment study that followed and resulted in new choices. Closer involvement of researchers in the follow-up led to more emphasis on the long term. Three temporal boundaries could be distinguished in the strategic environmental impact assessment study:

- Short term: 2010, plan horizon of the Development Sketch. In the development sketch for 2010, the vision of 2030 was used as a lead
- Middle long term: 2030, the vision year
- Long term: 2100 or described as a trend

General lower level of aggregation in the follow-up
The LTV was conducted on a generally high level of aggregation. In the LTV, questions were formulated that needed more time to be answered in detail for the follow-up study. A commissioner stated the following about the lower level of aggregation in the follow-up study:

> *In the follow-up phase the research goes a lot deeper, a lot more detail was involved and also research-technical demands played a role. Then political-strategic reasons played a less important role, because a more objective study was needed in which economic balances in the region were made.*

The level of aggregation in the follow-up also depended on the nature of the decision problem that was studied. Not all options were necessarily studied in greater detail. The decision problem at hand was to determine whether options would stay in as a relevant option or whether they were ruled out as an option.

6. Case description of the Water Shortage Study

The researchers always want to know in more detail what the problem is. They seem to keep busy with the problem analysis, trying to know in more detail how everything works. They are studying the influence of water shortage on recreation at the moment, while we are interested in the effects of policy options on water shortage.

-Pers. com. Policy analyst, Water Shortage Study, 2003

6.1. Context

6.1.1. Background

The water shortage situation in the Netherlands of 1998 was one of the events that gave rise to the Water Commission 21. The commission concluded that water shortage is an underestimated threat for the future water management in the Netherlands. The core of the problem is that, in cases of water shortage, it is not possible to serve all water needs because the demand for water exceeds the possible supply. Competing interests between different water users exist on different scales. In case of water shortage, priorities have to be set to decide how much water goes where. On the policy agenda, the water shortage problem has to compete with flooding. In the future, water shortage situations are expected to occur more frequently for a number of reasons. First, water demands are getting larger because people need more water. Second, it is being realised more and more that nature is an important competing function that needs water. Third, global climate change scenarios indicate that winters will become wetter and summers will become drier and hotter. Summers will have a higher probability of long dry periods. Heavy showers will also occur more often in summer.

Although actual life-threatening situations are absent in water shortage scenarios, the ecological and economic consequences might be great (Commissie Waterbeheer 21e eeuw, 2000). However, because water shortage is not life threatening, attention to the problem is less. Water shortage will therefore only get attention if suitable solutions and the advantages of solutions are clear (de Groen, 2003).

Water management in the Netherlands

In the Netherlands, the water system is man-made. The water in the large rivers is distributed around the country by weirs and sluices. Many sluices can distribute the water artificially in a fixed scheme to the regions. Despite the possibilities of human intervention in the water system during very dry periods, it is not possible to distribute the water in such a way that all areas receive a sufficient supply to serve all needs. To gain better insight into the water shortage problem in the Netherlands, some background of the Dutch water management system is given below.

A distinction is made between the main and regional water systems (see Figure 6.1). The main water system consists of the large rivers and large lakes. In the western part of the Netherlands, the regional water system consists of the water in 4000 polders and in contributing sub-catchments. The largest amount of water that enters the Netherlands originates from the river Rhine, equaling about 60% of the total amount. About 30% of the water comes from precipitation and 10% from other rivers (Huisman et al., 1998). In an average year the total supply is 2800mm. The largest amount of water (80% in an average year) flows through the rivers to the sea (Huisman et al., 1998). Across the country, an extensive system of weirs and sluices is present. This system of weirs and sluices has multiple functions. Its main function is to distribute the water throughout the Netherlands. Other functions are to maintain water depths for shipping, to average groundwater levels and to be able to pump water to sea level.

Distribution of the water in the main system can be controlled quite well. One of the most important weirs is the one at Driel which manages the distribution of water in times of scarcity between two Rhine branches: the Lek and the IJssel. Large regional differences exist in water needs (Resource Analysis et al., 2002). Between the regions, many differences in water supply possibilities are present, especially between the high and low areas of the Netherlands.
For example, in the higher areas (Veluwe, the eastern and southern parts of the Netherlands) the possibilities to supply water are limited (see Figure 6.1).

In water management, at different scales, different institutions and stakeholders play a role. In the Netherlands, the main water system is controlled by the Ministry of Transport and Water Management. The regional water systems are managed by the water boards. The water boards are represented on a national scale by the Union of Water Boards (UvW), in the provinces by the Inter Provinces Platform (IPO), and in the municipalities by the Society of Dutch Municipalities (VNG).

Figure 6.1: The most important waterways in the Netherlands for distribution and supply of water to the different regions (Source: Ministerie van Verkeer en Waterstaat, 2005b)

Table 6.1: Institutions on different scales in water management in the Netherlands

Scale	Institution	Responsibility
National	Ministry of Transport, Public Works and Water Management (V&W)	This ministry plays the largest role in water management in the Netherlands. It is responsible for the protection of the Netherlands against negative influences of water, and providing it with safe connections. In water shortage situations, the Ministry has to allocate water from the main water system as muchl as possible. *Directorate-General for Water Affairs*: Policy department responsible for arranging and maintaining a sustainable water system at a cost that is acceptable to society. *Directorate-General for Public Works and Water Management*: *(Rijkswaterstaat or RWS)*: this organisation of the Ministry implements policies on protection against flooding and providing sufficient water for all users. The organisation is also responsible for operational management and maintenance.
	Ministry of Housing, Spatial Planning and Environment (VROM)	This ministry is responsible for coordinating environmental policies at government level. However, unlike in many other countries, several other ministries have environmental tasks, too, for example in the field of water quality and nature management.
	Ministry of Agriculture, Nature and Food Security (LNV)	This ministry is responsible for agriculture, nature, recreation and fisheries.
	Union of Water boards (UvW)	Representation of the water boards on a national scale.
	Inter Provinces Platform (IPO)	Representation of the provinces on a national scale.
	Association of Dutch Municipalities (VNG)	Representation of the municipalities on a national scale.
Regional	Provinces .	In cooperation with 'Rijkswaterstaat' and the water boards, the provinces are responsible for regional policies on water management: surface water with regard to transport, (swimming) water quality, wastewater treatment and managing groundwater levels
	Water boards	A special institutional system exists for water management, with democratically governed organisations called water boards. Because of its democratic character (different actors who use water in the region are represented on the board) these institutions also protect the interests of the actors that need water in the region. These organisations are responsible for execution of regional water management. They manage the dikes, pumps and water levels in their region. In addition to protection against flooding and managing the quantity of the water, the Dutch water boards also safeguard the quality of surface water. The boundaries of the water boards are largely based on the water system, therefore water boards stretch out over regions that are, in size, between municipalities and provinces but their borders do not match with either one. In water shortage situations, the water boards need to allocate water in regional water systems as well as possible.
	Regional directorate of Rijkswaterstaat	The Directorate-General for Public Works and Water Management (RWS) has 10 regional organisations for operational management and maintenance.
Local	Municipalities	Related to water, the municipalities take care of wastewater discharge and the urban water.

In the Netherlands, some actors depend on the main system for their water and other actors depend on the regional water system. Shipping is dependent on the main water system for the maintenance of a certain navigational depths. Electricity production is a local activity. However, the power plants extract cooling water from the surface water of the main water system. In Table 6.2 a distinction is made between the functions that need water from the main system or from the regional system.

Table 6.2: Functions depending on different water systems (Source: Ministry of Transport and Water Management, 2001)

Functions depending on the national waters	Functions depending on the regional waters
Transport (shipping)	Agriculture
Electricity production	Drinking water supply
Industry	Nature conservation
Recreation	Recreation
Nature conservation	Greenhouses
Agriculture (distributed by the regional systems)	
Drinking water supply (limited)	

6.1.2. Problem situation

A clear distinction has to be made between water shortages as an incidental event and from structural droughts (see Box 6.1). In the Water Shortage Study, only incidental events were considered; the problem of structural drought was not taken into account at all.

Box 6.1: Water shortage versus structural drought

Water shortage: This refers to an incidental water shortage with negative consequences not only for nature but also for other functions that depend on sufficient water of adequate quality. The following definition is used in the Water Shortage Study: “Incidental periods in which the amount of water available is smaller than the amount desired” (Resource Analysis, 2002, p.3).

Structural drought: A structural water shortage refers to areas with an important nature function. In some regions in the Netherlands with a nature function, the groundwater level is continuously too low to protect the characteristic ecological values of the nature present in the area. Important causes of structural drought are: increased extractions for drinking water, industry and agriculture, and a faster water discharge for agriculture and urban development (Ministerie Verkeer en Waterstaat, 1996).

Water shortage can be caused by a shortage in precipitation, by a shortage in the river discharge and/or by too few possibilities to supply water in the area. The problem of water shortage has a long history in the Netherlands and is expected to grow because of climate change. For example, 1976 was an extremely dry year in which the water supply was 40% less than the average water supply. In the early eighties a policy analysis study was executed on the water management in the Netherlands, called the PAWN study. In the PAWN study, the cost effectiveness of possible measures to prevent water shortage was studied. This study focused on the main water system. An important lesson learned from that study was that the national water distribution appeared to be robust at that time and no changes needed to be planned (Pulles, 1985).

In general, problems associated with water shortage include:

- A decrease in water quality. High temperatures and a smaller amount of water lead to an increased risk of eutrophication and botulism.
- The intrusion of salt water. In coastal zone areas salt water from the sea may intrude if the groundwater levels drop. This leads to a disturbance of the ecological balance and damage to agriculture
- The shutdown of power plants and water-using industries (temporarily).
- A watering prohibition, which leads to damage of agriculture and private gardens
- A hindrance for shipping due to the low water levels in the rivers

(source: www.droogtestudie.nl)

The season in which a water shortage situation occurs has a large influence on its consequences. Water shortage situations in spring, for example, can have severe consequences for nature and agricultural crops while water shortage situations during the late summer can have much less severe consequences because the plants have by then reproduced and the crops have been harvested.

In dry situations the National Coordination Committee for Water Distribution (Landelijke Coordinatiecommissie voor Waterverdeling) coordinates the measures that must be taken to maintain groundwater depths and water extraction events (Landelijke Coördinatiecommissie Waterverdeling, 2001). Only a few policy options exist on a national scale, but they have large effects across the regions:

- Water inlet from the IJsselmeer to the south has a lot of effects on the IJsselmeer regions.
- Division in the Pannerdensch Kanaal mainly determines how much water goes north and how much water goes west.

In water shortage situations, the available water must be allocated as best as possible. For these situations rules have been designed which are formulated in the Maintenance Plan for National Waters (Beheersplan Rijkswateren, Ministerie van Verkeer en Waterstaat, 2001). This priority setting is presented in Table 6.3. The priority setting in the Netherlands was established in 1986 in the Second National Water Management Plan and was based mainly on the results of the PAWN study of 1985.

Table 6.3: Priority setting (*verdringingsreeks*) between competing interests in water shortage situations (starting point at the start of the WSS)

1	**2**	**3**
Maintenance of a certain groundwater depth (in order to prevent irreversible damage on foundations caused by drought, and conservation of stability of weirs)	• Drinking water supply • Water supply for green houses • Industrial withdrawal	• Conservation of low salt concentrations • Cooling water for energy plants • Water supply for agriculture • Maintaining nautical depths for shipping

The national priority setting that is presented in Table 6.3 had been under discussion between policy makers for a long time because of its limited applicability and outdated character.

Observed problems in the national priority setting were:

- The priority setting was defined on a national scale and was not suitable for the regional scale. It was questionable if priorities could be set in a uniform way that applied to all scales. In the regions, in theory, the same priority setting was used, but in practicethe regional priority setting appeared to be different according to the water boards. This seems to be logical: when a water board is confronted with a water shortage situation in its area the measures taken by the water board are on a scale that the water board is authorised to make. In regional water shortage situations, agriculture seemed to be the first sector to make sacrifices: it is one of the few sectors that plays a role in the regional water system and that can be regulated by regional institutions such as water boards. The priority setting that was present at the beginning of the study, therefore, seemed applicable to a limited extent.
- The priorities seemed to be regionally differentiated. For example, in the southern part of the Netherlands, the Biesbosch basins provide drinking water to Rotterdam; in that region drinking water has a very high priority. Along the Amsterdam-Rijnkanaal, there is a large concentration of industries. Cooling water is considered a very important function in that region.
- Since 1986 some changes had occurred in functions and the appreciation of them. For example, the valuation ofr nature was steadily growing. In the early priority setting, nature was not mentioned at all. Therefore, the priority setting seemed outdated.

6.1.3. Actors involved

Tables 6.4 and 6.5 give an overview of the actors involved in the problem situation, their general and specific interests in the problem situation. A distinction can be made between the governmental actors and the stakeholders with interests. A lot of institutions at different scales play a role in the water shortage problems, as shown in Table 6.4. Competing interests exist between actors that need water. Table 6.5 provides a list of the most important stakeholders.

Table 6.4: Governmental organisations involved in the problem situation of water shortage

Governmental organisation	Interest in the problem situation
Ministry of Transport and Water Management	Optimise the water distribution to accommodate different functions Keep overall consequences of water shortage as small as possible
Ministry of Agriculture, Nature and Food Security	Prevent negative consequences of water shortage on nature and agriculture
Union of water boards	Prevent the water shortages in the regional waters in general
Water boards	Prevent problems caused by water shortage in their area
Platform of the Dutch Provinces (IPO)	Prevent structural water shortages and its consequences for nature
Provinces	Prevent structural water shortages and its consequences for nature in their province
Association of Dutch Municipalities (VNG)	Prevent damage by water shortage to foundations of buildings
Municipalities	Prevent damage by water shortage to foundations in their municipality. Prevent a shift of the problems from the main water system to the regional water system

Table 6.5: Stakeholders involved in the problem situation

Stakeholder	Interest in the problem situation
National Agriculture Organisation (LTO), regional agriculture organisations, individual farmers	Prevent negative effects of water shortage on agriculture. In the agriculture sector different effects can be distinguished that are caused by water shortage: • Fewer crops or crops of a lower quality • Increase of production costs (for example due to increased irrigation) • Increase in prices of crops (smaller supply and equal demand) for which the consumers have to pay
EnergyNed, electricity companies	Prevent negative effects of water shortage on electricity production. Electricity companies have problems obtaining sufficient cooling water, which results in electricity companies not operating at full capacity or in a temporary closure. In extreme cases this may result in threats to the electricity supply or extra investments in spare capacity or cooling towers.
Association of Drinking water companies (VEWIN)	Prevent negative effects of water shortage on drinking water supply.
Shippers	Prevent negative effects of water shortage on shipping. Shipping may be faced with limited navigational depths in the rivers.
Industry	Prevent negative effects of water shortage on production. In industry a shortage of process water results in a lower turnover. Also, emissions from process water may be restricted because of an increase in the temperature of the water.
ANWB/ holiday makers	Prevent negative effects of water shortage on recreation. Water shortage may cause a decrease in water quality which may result in fewer tourists or day recreation.
Nature organisations	Prevent negative effects of water shortage on nature. Water shortage may cause a decrease in water quality which has a negative effect on nature.

(Based on Ministerie van Verkeer en Waterstaat, 2005a)

6.2. Policy analysis process

6.2.1. Assignment

Based on the advice of the Commission Water Management 21 to the State Secretary of the Ministry of Transport and Water Management, a Memorandum of Understanding was signed between the national government, the provinces, the water boards and the municipalities. In this agreement, a number of actions on water management are mentioned, amongst which is a study of water management during extremely dry situations (Startovereenkomst, 2001). This study had to support the ministry in selecting appropriate measures to prevent and/ or reduce water shortage situations (Startovereenkomst, 2001). In 2001, the State Secretary of the Ministry gave the assignment to the National Research Institute for Water Management and Waste Water Treatment (RIZA) to supervise and execute the study on water shortage. RIZA was at that time a research institute of the Ministry of Transport and Water Management. RIZA could, if needed, involve other institutes and consultants for the conduct of sub-studies (Startovereenkomst, 2001).

6.2.2. Objectives

The goal of this study was to assess current and future water shortages and to identify possible countermeasures. The policy objective in the study was formulated as follows:

"Make the difference between demand and supply of water as small as possible at acceptable societal costs (not only based on monetary costs, but also taking into account environmental aspects and emotions" (Resource Analysis, 2002, p 6).

It was realised that water shortages could not be prevented, therefore the new policy would probably contain agreements (protocols) to optimally allocate the water if water shortages occurred, taking into account the different interests that played a role (ibid.). Another important policy objective was to place the problem of water shortage on the agenda in a period during which a lot of attention would be given to flooding.

In the period of the execution of the WSS, negotiations took place about the National Policy Agreement-Water. This water policy agreement was expected to focus especially on flooding problems and their solutions. Therefore, it was considered important to provide information on water shortage problems to the people involved in preparing the National Policy Agreement-Water to make sure that a paragraph in the Agreement was devoted to water shortage problems. Solutions for flooding can have a negative impact on water shortage situations, therefore it was also considered important to bring the message that problems of water shortage and flooding should be studied in an integrated way.

Classification of objectives of the study and managerial constraints
In this study analytical objectives played a key role. If the Water Shortage Study has to be described according to the goals of the study as mentioned in the hexagon model for policy analysis activities (Mayer et al., 2004), the main goals of the study were to assess the problem of water shortage and to provide insight into policy measures. Therefore, the major activities consisted of research and analyse, and design and recommend. The assessment of the problem played a key role in Phase 1 of the study. In Phase 2, a switch was made to the design of policy options to prevent water shortage and to respond to water shortage situations.

A strategic function that was important in this study was *placing a problem on the agenda*. This objective was thought to have been achieved if support for the problem of water shortage was present at the end of the study.

Overall, managerial constraints did not play an important role in this policy analysis project. One of the reasons was the orientation of the study being research and analysis. There was no urgency to finish the study. At the start of the study there seemed to be a rush to deliver information to the National Policy Agreement-Water but this was postponed for almost half a year. Phase 1 of the study ended on time. Financing for Phase 2 was postponed for over a year. When Phase 2 started, its planning was far more focused on the decision makers' agenda. Phase 2 was supposed to finish at the end of 2003 but finished in July 2005. Table 6.6 shows an overview of the function of the study and the managerial constraints. One of the commissioners of the Water Shortage Study explained why he did not consider the managerial constraints of the study an important issue:

> *It is important that a study ends in a result. Of course, the study was delayed very much. But we never said that it had to be finished at a certain time. Sometimes things take longer than expected and cost more money than expected, but that is not a real problem for the Ministry: if*

we think it is necessary we will find the money. The time pressure is provided by the political momentum: for example, if a calamity happens you have to be ready to draw conclusions. Also, the results of studies have to be taken into account in the policy notes. That causes time pressure.

Table 6.6: Overview of goals of the WSS (from the perspective of the commissioners) and managerial constraints of the study

Formal goal of the study	Major activities	Strategic goal of the study	Managerial constraints (time and budget)
Understand the problem of water shortage Provide insight in policy measures	Research and analyse Design and recommend	Place problem on the agenda	Playing a minor role

6.2.3. Project approach

The project was executed along two tracks: a process (and communication) track and a research track, also called the technical track (see Table 6.7). Between the two tracks, information was exchanged extensively and in a structured way. In the beginning it was said that the emphasis was to be put on the process track in which the crucial questions would be asked that would lead to the technical track. In Table 6.7 the characteristics of both tracks are described.

Table 6.7: Characteristics of the process and research tracks in the WSS

	Process	Research
Goal	Obtain societal support for optimal water management during periods of water shortage	Supply information that is needed for the preparation of new policy on water shortage
Means	Workshops, called water shortage days, and discussion meetings in which private actors and regional policy makers participated	Intensive modelling (update of current models and development); Technical description of water management and quantitative analyses based on actual information and knowledge

Two phases could be distinguished in the study. In Phase 1 the problem assessment was emphasised (February 2001-June 2003), and in Phase 2, the design of options (September 2003- September 2005). In Phase 1, a problem analysis was made and solution directions were investigated very globally. This information was aggregated and delivered to Policy Agreement-Water (between the national, provincial and municipal government and the water boards) in July 2003. In this phase, it was realised that a lot of uncertainties regarding the water shortage problem were present. After a few months of study, the question was even raised whether the water shortage problem had to be seen as a problem at all and, if so, how serious would the problem be. For a short while, the urgency of the study was under discussion. At the end of Phase 1 an evaluation was made in which the results of that phase and the process so far were discussed before starting Phase 2. In the summer between Phase 1 and Phase 2 a crucial event took place: the water shortage situation of 2003. It drastically influenced the commitment to the remainder of the study because the problem was immediately placed on the political agenda.

Phase 2 of the study consisted of an integrated policy analysis with proposals for policy measures. In this phase, the study became much more politically loaded. The focus shifted from problem assessment to solution finding, which was more interesting to the political actors involved. The problem of water shortage gained more importance on the political agenda because of the recent water shortage situation. Also, regional actors were starting to feel more dedicated to the problem. At the beginning of Phase 2, parallel to the national Water Shortage Study, two regional studies were started on this issue: the water shortage study of the Central-Western part of the Netherlands and the water shortage study of the Meuse River basin area that covers the southern sections of the Netherlands. In Phase 2, also round table meetings were organised to involve regional actors and sector-specific stakeholders more actively.

Three types of measures were thought to be present (Resource Analysis, 2003):

- *Prevent* structural measures to make sure that the water shortage in dry periods are as minimal as possible (improve water supply possibilities, influence demand by for example moving crops that are sensitive to drought)
- *Respond to* operational measures in case of water shortage (optimal distribution of water) to reduce the negative consequences
- *Accept* certain amounts of economic and ecological loss (fewer crops from agriculture, deterioration of nature) and compensate losses. No countermeasures will be taken to prevent the damage from water shortage situations; the damage will, so to speak, be accepted. One solution in this category is to develop a damage fund (p.6).

6.2.4. Organisation

In the study in general, two groups can be recognised: The project was executed by a project group. A steering committee was installed to guide the project. In Phase 1, the Steering Committee reported directly to the State Secretary. Because of the shift in focus of the study in Phase 2 from research oriented to design of options oriented, the governmental relevance became more significant. Therefore, the governmental input had to be greater. In Phase 2 of the study, the Steering Committee was therefore replaced by a number of commissions, called the Governmental Column. Figures 6.2a and 6.2b give an overview of the actors involved in the study in both phases.

Steering Committee

The Steering Committee consisted of representatives from the Ministry of Transport and Water Management (Directorate-General Water); Rijkswaterstaat; the Ministry of Agriculture, Nature and Food Security; the Ministry of Housing, Spatial Planning and Environment IPO; the Union of Water Boards; the Inter Provinces Platform; and, the project leader and the communication advisor from the Project Group. The representative of the Directorate-General Water was the chairman of the Steering Committee. The role of the Steering Committee was to ensure policy relevance of the results of the study. The Steering Committee was continuously involved in the project through regular meetings in which the progress of the project was discussed. Although the Steering Committee was intended to lead the project from a distance, in the evaluation after Phase 1, it was concluded that the Steering Committee was so closely involved that they had the tendency to go too much into the (technical) details (de Groen, 2003).

Governmental Column

The Governmental Column consisted of four groups that functioned together as the Steering Committee of Phase 2 of the project: an official coordinating committee on water shortage, coordination group-water, steering group-water, LBOW (national policy makers' consultation group-water).

Project Group

The Project Group was responsible for the execution of the project. The Project Group was guided by the Project Leader of RIZA. Many RIZA researchers were involved in the technical track. Although it was thought that the study could have been conducted by RIZA alone, the explicit choice was made to involve independent policy analysts to make sure that the study was not seen as the Ministry's study. The consortium of Resource Analysis (later Arcadis), HKV Lijn in Water, and Korbee & Hovelynck got the assignment to guide the project. The project group additionally consisted of representatives at the national level (Ministry of Agriculture, Nature and Fishery, rural areas) and representatives of the regional level (RWS Zuid-Holland, and two water boards, representing high and low Netherlands). Involvement of the regional actors was considered important because the actual water shortage problems become visible on a regional level. Also, the regional actors had not been involved in the PAWN study, the policy study that followed the drought of 1976. Therefore, the commitment of the regional actors to the results of the PAWN study was very limited.

Table 6.8: WSS Project Group in the process track and the research track

	Process	**Research**
Responsible actors	Overall project leader and policy analysts	RIZA project leader technical track and consultants
Actors involved	Governmental organisations that are involved in the problem of water shortage, societal sectors that are involved in the problem of water shortage, relevant knowledge institutes	20 RIZA modellers and specialists and several contracted consultants

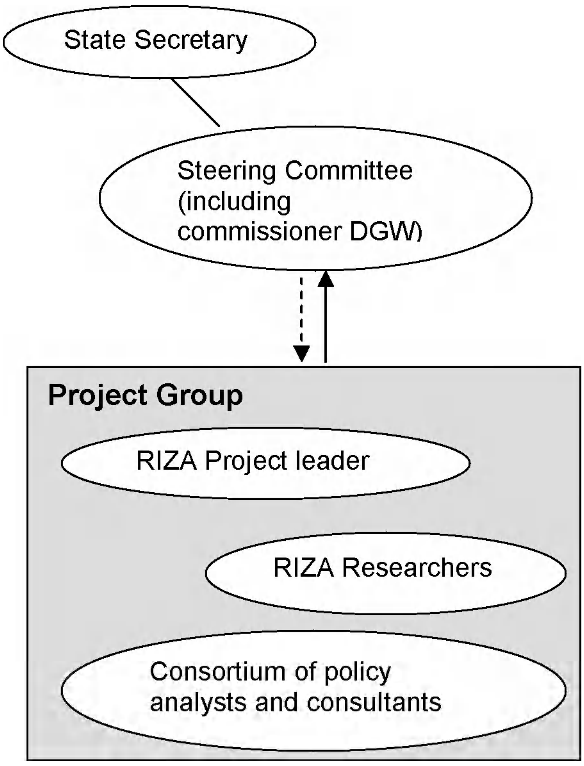


Figure 6.2a: Organisation of the WSS Phase 1

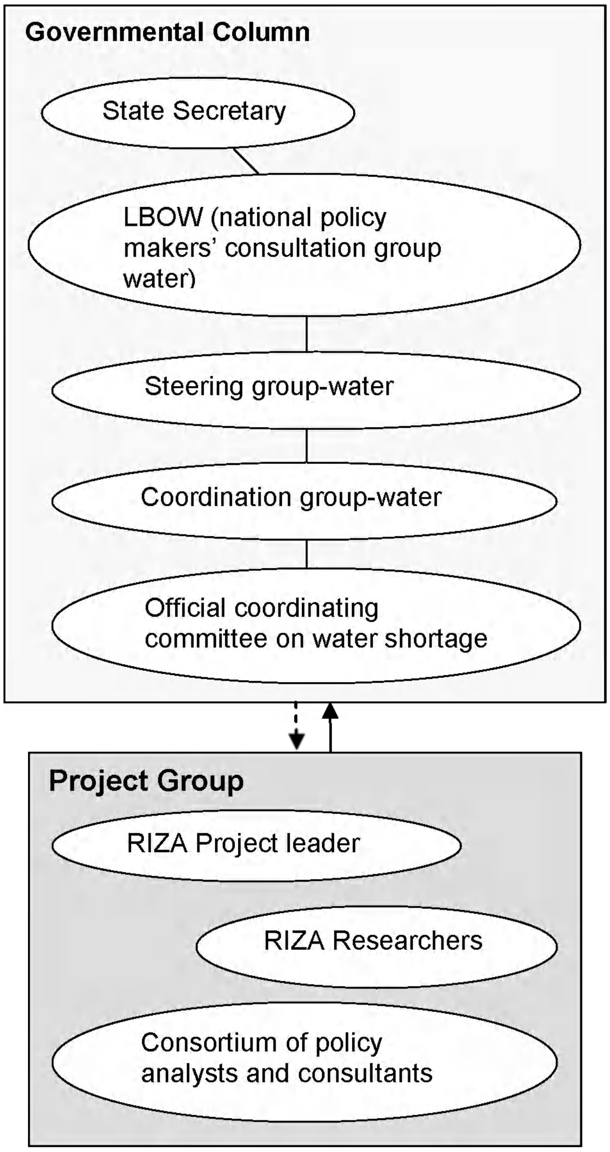


Figure 6.2b: Organisation of the WSS Phase 2

Classification in actor archetypes

The actors involved are categorised in Table 6.9 into the actor archetypes according to the typology described in Chapter 4 in order to aggregate statements and derive more general statements than at the specific actor level.

Table 6.9: Categorisation and description of actor archetypes involved in the WSS

Actor archetype	Description
Political actor	The category of political actors is subdivided into national political actors (national government officials of the Steering Committee, national representatives in the project group) and regional political actors (regional government officials of the Steering Committee and regional representatives in the project group).
Commissioner	The Directorate-General-Water of the Ministry of Transport and Water Management
Policy analyst	Project leader of RIZA and consultants of Arcadis (former Resource Analysis)
Researcher	A large group of modellers of RIZA and consultants of HKV Lijn in Water were involved from the start. The researchers were mainly ecologists, hydrologists and economists.

6.3. Scale decision making

6.3.1. Spatial boundary setting

The Commission on Water Management 21 (WB21) advised the national government to start a Water Shortage Study on a national level. The State Secretary followed this advice. So, the Ministry of Transport and Water Management made the decision on the spatial boundary setting without involving other actors. Therefore, no alternatives were discussed.

In the project plan (RIZA, 2001) a lot of attention was paid to the arguments supporting the choice for the national scale. In the literature, a common justification for ceding decision making about water resources to the national level is that centralised coordination, command and control are needed to ensure supply and fair water allocation (Lebel, 2005). In the project plan it was indeed repeatedly argued that the national scale was considered to be the one and only suitable scale for to analyse water shortage because some decisions on water distribution transcend the regional level (RIZA, 2001). Two examples that were mentioned are:

- The water division along the Rhine branches is determined, in part, by the water demand in Northeast Groningen (the river basin of the Eems), and the northern and southwestern areas of the Netherlands.
- The water supply to the delta of Zuid-Holland and Zeeland takes place through the Rhine, the Meuse and the Scheldt rivers. (p.5)

Another reason that was mentioned for a study on a national scale was the possibility of taking meteorological droughts into account, which was impossible on a river basin scale because of the lack of data on that scale. For a good description of the problem, the study must not be limited to the low river discharges but also had to take into account the meteorological droughts in the Netherlands because droughts determine surface water demands (RIZA, 2001).

Although the study was executed on a national scale, it was recognised from the start that important parts of the water demand are regionally oriented and that water shortage problems manifest themselves mainly on a regional scale in the Netherlands (RIZA, 2001). A short time

before the actual Water Shortage Study started, an actor analysis on a national scale (Buijsrogge, 2001) was performed as assigned by the project leader of the WSS. This analysis showed that although the national scale was the starting point, many national actors considered a strong involvement of the regional and local actors important. A sound problem analysis on a regional level was considered essential for an optimised priority setting that required close cooperation with the regions. Regional assessments were thought to be an essential part of the Water Shortage Study.
At the start of this study, a parallel process was initiated to conduct a study on the water supply and shortages in the southwestern part of the Netherlands. One of the main reasons for this study was the saltwater intrusion problem that this region was faced with (RIZA, 2001). Also, in 2004 a parallel track was started for the Meuse River basin, mainly the Dutch part, but the international aspects were taken into account as well. Other regions were also stimulated to start regional studies.

So, although the national scale was selected, also a lot of emphasis was put on involving the regional scale in the study from the start.

Major dilemmas
The discussion on spatial boundaries concentrated mainly on the national and regional scales. In line with van Twist et al. (1998), tension bows were used to visualise the trade-offs that needed to be made in the WSS (for an explanation of the tensions bow diagrams see also Section 4.5.3). In retrospect, the following dilemmas can be identified:

Agendising possibilities versus responding possibilities
It appears to be difficult to put the problem of water shortage on the political agenda. Although it may seem logical to start to put the problem on the agenda at the scale at which it plays out, this is thought to be difficult at the moment when the study started because in the regions the actors were absorbed by the flooding problems. The national government felt committed to the problem of water shortage because it was worried about the climate change scenarios. The responding possibilities were thought to be best at the regional level. Even before the study started, all the actors involved realised that the options available on a national scale would be limited.

Prevent shift of the problem to another area versus address the problem at the scale at which it becomes visible
If the study were to be conducted on a regional scale, the regions could blame other regions or the national government for their own problems with water shortage. Also, they could suggest measures that might seem effective from their perspective, but might be harmful to other regions. To prevent this from happening, a national scale would be required. On the other hand, it would be more logical to address the problem at the scale at which it becomes visible and probably has to be solved.

Authority of the commissioner versus commitment of the actors involved in the problem
The Ministry of Transport and Water Management is the actor that wants to set the problem for discussion. The only way to do this is to start a study on a national scale because that scale matches their level of authority. On the other hand, performing a study on a national scale leads to less commitment and a wait-and-see attitude with the regional actors. The actor analysis performed by Buijsrogge (2001) showed that the regional actors (water boards, provinces and municipalities) would not be dedicated to a water shortage study on a national scale. They even indicated that they did not want to be involved in the study. This would be

quite problematic because many solutions for the water shortage problem have to be implemented at a regional level. If they are not involved in the study at a regional level in the first place, they might not feel committed to the solutions that are suggested in the national study.

As a result, a tension bow was constructed and is displayed in Figure 6.3.

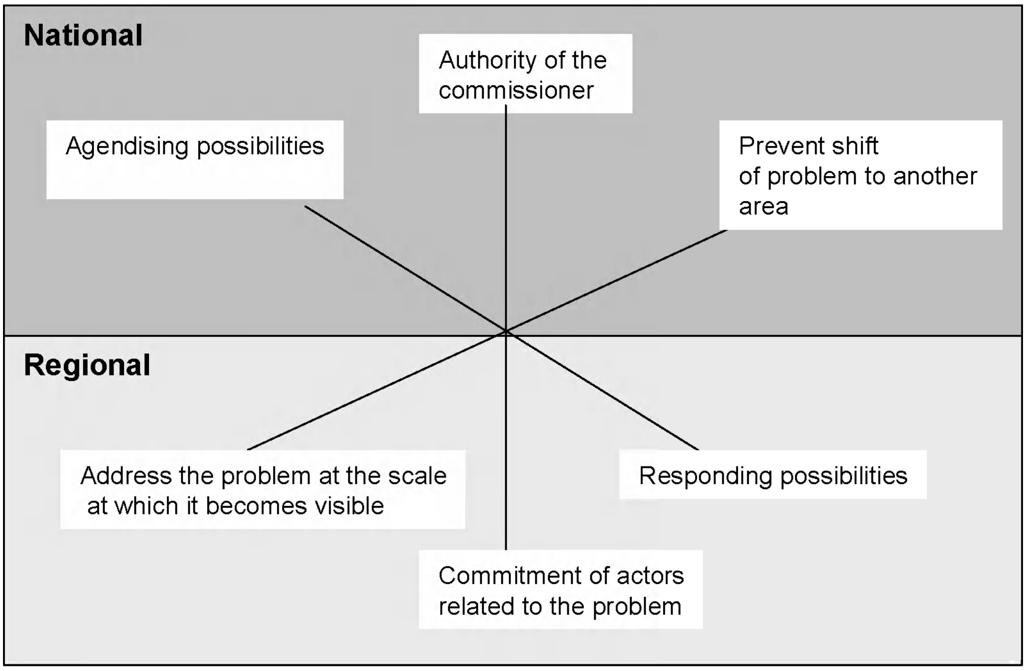


Figure 6.3: Tension bow diagram for spatial boundary setting in the WSS from the perspective of the policy analyst

6.3.2. Temporal boundary setting

The Commission on Water Management 21 (WB21) advised the national government to start a water shortage study using the temporal boundaries of 2005, 2015 and 2050, based on the fact that 2005 could be considered a reference point, 2015 is an important year in the entire WB21 process, and 2050 is important to take into account based on climate change. The State Secretary agreed with this advice. The political actors, the policy analysts and the researchers became involved after the temporal boundaries were set.

Already in the project plan (RIZA, 2001) a distinction was made between products of the study for the short term and those for the long term. For the short term, the study had to deliver protocols on how to handle water in periods of water shortage (RIZA, 2001). Also, the project had to create a sense of urgency. For the long term, the study had to provide sound policy options in which the infrastructure or the use of the infrastructure was adjusted to anticipate future periods of water shortage (RIZA, 2001).

All actors agreed that selecting a single scale would be a far less superior option because the long term and the short term both have their advantages.

A commissioner explained the importance of the balance in the temporal boundaries for this study:

> *It is important to find a good balance between short term and long term. If we select a term that is too short, only simple technological solutions come into the picture. If we select a term that is too long, we do not create a sense of urgency. I always like to determine the time scale by asking: what do we want politically? In that respect I think it is best to combine the different time scales.*

Major dilemmas

The most important temporal boundaries that played a role were the years 2015 and 2050. Although dilemmas were present, no real choices regarding these dilemmas had to be made because both temporal scales were considered. Nevertheless, as recommended by van Twist et al. (1998), tension bows were constructed to visualise the differences in focus between the two temporal scales (for an explanation of the tensions bow diagrams see also Section 4.5.3). In retrospect, the following dilemmas can be identified:

Inclusion of structural solutions versus action ability/ sense of urgency

The year 2050 offers the possibilities of including more structural options but the action ability is reduced. Simple, realistic options are on offer for 2015. Options are expected to be local, so they must not be too pretentious but very actionable.

Match with planning term of infrastructure versus match with other policies

Significant infrastructure options need to be discussed on a large scale because of the long realisation term and the long term of return on investment. On the other hand, the match with other policies, like WB21, EFDW and NWB would lead to a preference for 2015.

Focus on irreversible effects of nature versus focus on economic damage

Nature and economics have different focus points in the future. It is difficult to assess economic damage on a longer term than 10 years because of the number of uncertainties in economic development that play a role. On the other hand, the irreversible effects on nature take a long time before they become visible.

Possibilities of taking uncertainties into account due to climate change versus model reliability

Within the research, a complex trade-off is present because the uncertainties are large. The reliability of the model is best if the temporal boundaries are limited because, then, the uncertainties are limited. On the other hand, it is important to involve uncertainties such as climate change because they play an important role in the size of the problem and therefore add to realistic results. An important point here is the communication about uncertainty: actors have to be aware of the limited reliability of the models.

In Figure 6.4, the tension bows for the temporal boundary have been visualised and represented in a diagram.

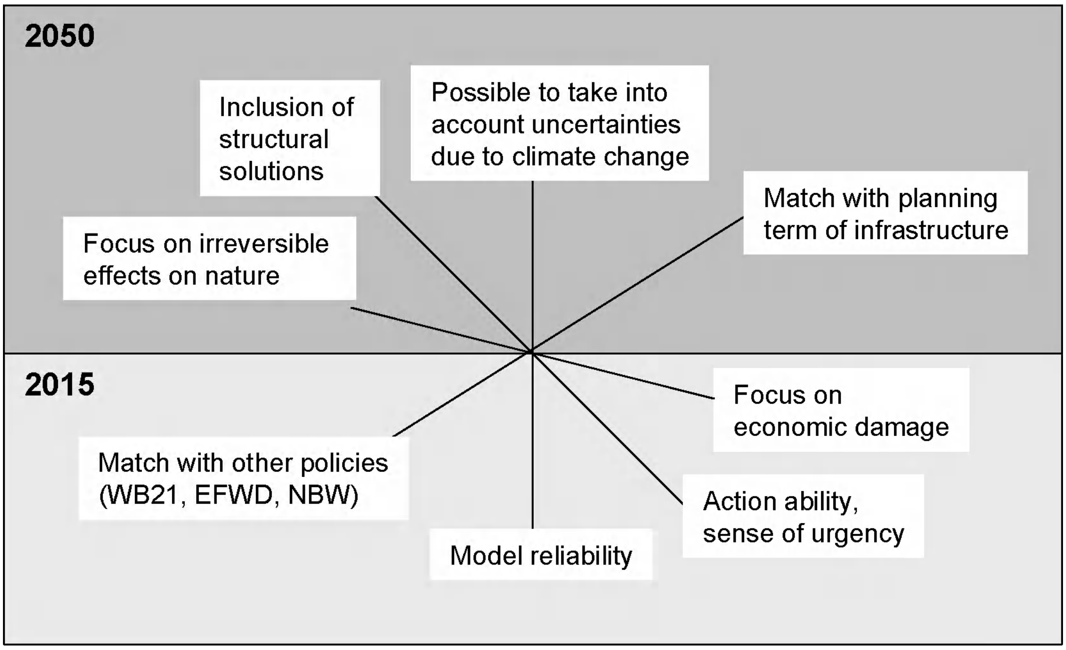


Figure 6.4: Tension bow diagram for the temporal boundary setting in the WSS from the perspective of the policy analyst

6.3.3. Selection of the level of aggregation

At the start of the study, a high level of aggregation was selected because one of the urgent goals set was to deliver information to the National Policy Agreement-Water. The requirement was made that the information delivered had to be restricted to twenty lines, which was stated as one of the reasons for the initial high level of aggregation selected (RIZA, 2001). In the project plan, the level of aggregation is said to be rather high (RIZA, 2001), but not clearly indicated.

After the start, at different times, a new selection for the level of aggregation was made. In discussion with the actors involved, two important decision moments for the selection of the level of aggregation were identified that played a major role throughout the study: the level of aggregation in the modelling studies, and the level of aggregation in the presentation of the results. These are discussed below.

Selection of level of aggregation in the modelling studies
Before the study started, an inventory was made of the existing models and data. Table 6.10 shows the results of this inventory.

Table 6.10: Overview of available models (from Luiten, 2001)

Model	National scale	Regional scale
Level of aggregation	High level of aggregation	Low level of aggregation
Focus	Water demand and supply and economic, ecological and societal effects	Water quantity and water quality
Usability	Yes, but data need to be actualised	Questionable because of large diversity

During the kick-off meeting, the role of the models in the study was discussed. It was stressed that models were the means and not the ends, the analysis mattered most. The general opinion was that the available models should not lead the approach to the problems. Models that were available would be used at first, but when they appeared not to be suitable for the study it should be determined whether new models needed to be developed or existing models needed to be adjusted (Luiten, 2001).

In the modelling studies, the researchers dominated the selection of the level of aggregation.

The selection of the level of temporal aggregation in the modelling studies was not a choice that led to any discussion. Water shortage takes place during a week to a few weeks per year. This required the inclusion of small time steps in the model. Also, the effects of water shortage depend on the time of year in which the shortage is present. For example: A water shortage situation in late summer can have fewer consequences for agriculture because a lot of crops have already been harvested. It was obvious, therefore, that seasonal variations had to be taken into account, so monthly time steps were considered.

A differentiated level of spatial aggregation was used in the modelling. The general choice for the spatial level of aggregation was to use modelling units of 500 x 500 metres. This was mainly based on the available hydrological models from the PAWN study. Additional options that were discussed were units of 250 x 250 metres and units of 25 x 25 metres, but these were considered too detailed. These can all be regarded as low levels of aggregation when talking about an area as large as the Netherlands. Also, data availability played a large role in the selection of the level of aggregation: when a lot of data were present, which was often the case, a low level of aggregation was selected and when only little data were present, a high level of aggregation was selected. For example, for drinking water, shipping and recreation a higher level of aggregation was used in the modelling. Ecology was also done on a high level of aggregation but evaporation was modelled in detail. This appears to be contradictory to the agreements in the kick-off meeting that the available models should not become armour for the problem approach (Luiten, 2001). During an interview held at the end of the study, a policy analyst remarked about the differentiated level of aggregation:

> *Although the choice the level of aggregation was rather pragmatic and mainly related to the available data and models, it appears that the sectors that demand most of the water like agriculture have been modelled in the greatest amount of detail. So the selection of the differentiated levels of aggregation can be justified.*

Major dilemmas in the selection of level of aggregation in the modelling studies

As suggested by van Twist et al. (1998), tension bows were used to visualise the trade-offs that needed to be made in the selection of the level of aggregation in the modelling in the WSS (for an explanation of the tensions bow diagrams see also Section 4.5.3).

In retrospect, the following dilemmas that played a role in the discussions on the level of aggregation during the study can be identified:

Generating understanding in processes versus optimisation possibilities

A model at a high level of aggregation might provide more understanding of the processes that play a role, while a model at a low level of aggregation is more like a black box. A detailed model, on the other hand, provides a lot of possibilities for fine tuning.

Interestingness for the target group versus a match with the initial goal of the study
The target group of the study (the regional actors that have to continue this study in their regions) was very interested in the detailed models. The initial goal of the study, however, was to provide information, restricted to some number of lines, to the National Policy Agreement-Water.

Time efficiency by a flexible model versus time efficiency by using available models
This dilemma is shaded by lots of uncertainties. It may be efficient to use the detailed available models, because you have a good base to start from. The downside is that the available models are quite complicated and linking them in a good way is a challenge.
To start with a model at a high level of aggregation from scratch may also be efficient because the new model can be designed with a clear structure and odd results can be explained, because the high level of aggregation of the model contributes to more of a process orientation and thus to a better understanding of what is actually going on.

In Figure 6.5 the tension bow diagram for the selection of the level of aggregation of the modelling is displayed.

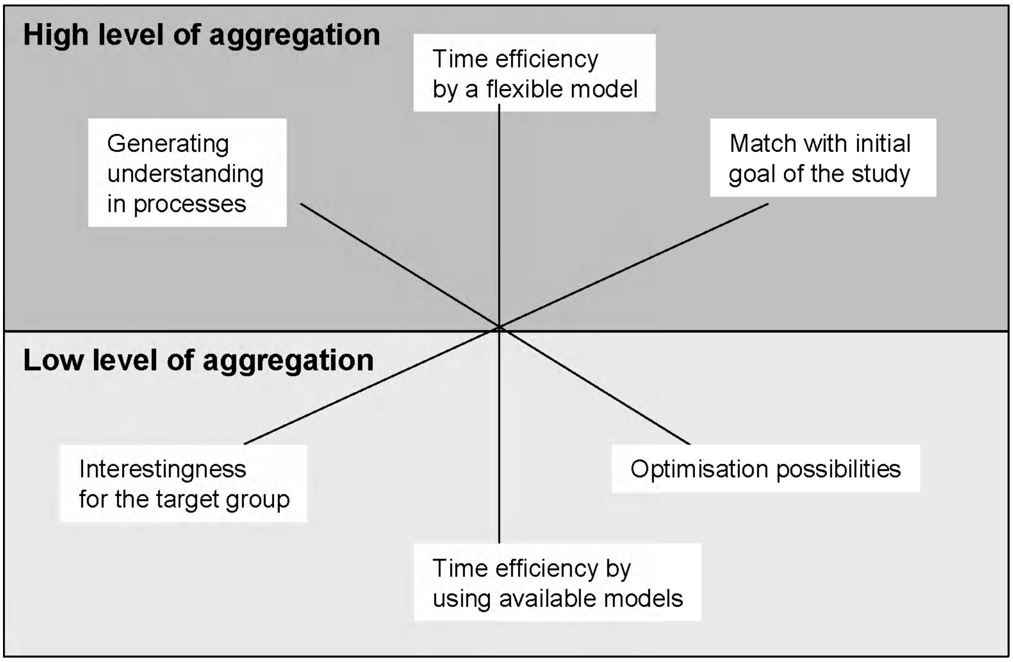


Figure 6.5: Tension bow diagram for selection of level of aggregation of the modelling in the WSS from the perspective of the policy analyst

Selection of the level of aggregation in the presentation of end results
In the selection of the level of aggregation in the presentation of the end results, the political actors also played an important role. The presentation of the water shortage situation did not raise much discussion. It was clear that the water boards and the provinces had to take the next step. In order to ensure the recognisability of the results for the water boards, a low level of aggregation was selected. Similar districts that were used in the PAWN study were used to present the results. For different subjects, different levels of aggregation were used that mainly related to the relevance and availability of the data. Sometimes, a lower level of aggregation was used than the district level:

- The saltwater intrusion was only relevant near the coastline, the results were presented at 500 x 500 metres in the coastal area.

- The results for terrestrial nature were presented on a 1 x 1 kilometre scale because a presentation on the district level was thought to be meaningless. It must be possible to recognise the nature areas. In the modelling, a value was attached to the quality of nature: is it getting better or worse? If results are averaged too much, it might be concluded that an area in which the quality improves and an area in which the quality deteriorates add up to a situation with no change at all. So, a low level of aggregation was needed to prevent people from drawing the wrong conclusions.

Sometimes, a higher level of aggregation was used than the district level. In general, this was mainly related to limited data availability and the uncertainty of the results:

- For agriculture, only six regions were presented. The limited data availability played an important role in this selection. To prevent discussions focusing on the wrong points, a high level of aggregation was selected. The damages were based on the statistics of the Dutch Meteorology Institute (KNMI). The uncertainties in the scenarios were very broad.
- Recreation was presented for 11 economic regions based on data and model availability.
- For cooling water, only the points with the largest problems were presented.

A big step up in the level of aggregation of the presentation of the water shortage assignment
The Governmental Column that had a national orientation considered the division in PAWN districts too detailed and wanted the results on the water shortage assignment to be presented at a higher level of aggregation. Concerning the water shortage assignment, a lot of discussion took place that mainly focused on two alternatives: the 7 European Water Framework Directive regions (EWFD regions) or the 17 WB21 regions. First, the EWFD regions were selected by the coordinating committee on water shortage. At a later stage, however, the WB21 regions were selected because the Steering Committee did not agree and overruled the previous committee's decision. The reason for this level of aggregation being selected was that the water shortage study was performed under the National Policy Agreement-Water and, therefore, the WB21 regions had to be selected as the level of aggregation.

Finally, on the website, both EWFD regions and WB21 regions were presented. In this way both people involved in water shortage (who are used to working with WB21) and people who were involved in EWFD (who are used to working with EWFD regions) were reached.

The interactive models that were presented on the website had a resolution that was based on WB21 and EU Framework regions. Every user could choose which of these two modes of presentation was preferred. This was necessary because otherwise the databases would be too large and the computation time would be too long.

Major dilemmas in the selection of level of aggregation in the presentation of end results
Following van Twist et al. (1998), tension bows are used to visualise the trade-offs that needed to be made in the selection of the level of aggregation in the presentation of the results in the WSS (for an explanation of the tensions bow diagrams see also Section 4.5.3). In this case, the EFDW regions and the WB21 are indicated as a high level of aggregation and the districts are indicated as a low level of aggregation. In retrospect, the following dilemmas can be identified:

Fit with the legal framework versus recognisability for the target group
The legal frameworks, like the Policy Agreement-Water (related to the WB21) and the European Framework Directive Water, often have a high level of aggregation. To be able to connect with the regional actors, it is necessary to present the results on a level of aggregation

that they can recognise, i.e. are familiar with. That often results in a lower level of aggregation.

Clear large picture versus visibility of options
A high level of aggregation emphasises the big picture while a low level of aggregation, in this case, also makes it possible to show the regional options that are present.

Prevention of discussion versus generation of discussion
Sometimes, discussion of the results may not be desired. Then it is possible to avoid criticism by presenting the results on a higher level of aggregation.If feedback is wanted on the results, it may help to present them on a level of aggregation at which the public can react.

In Figure 6.6, the tension bows for the level of aggregation in the level of aggregation are illustrated with a diagram.

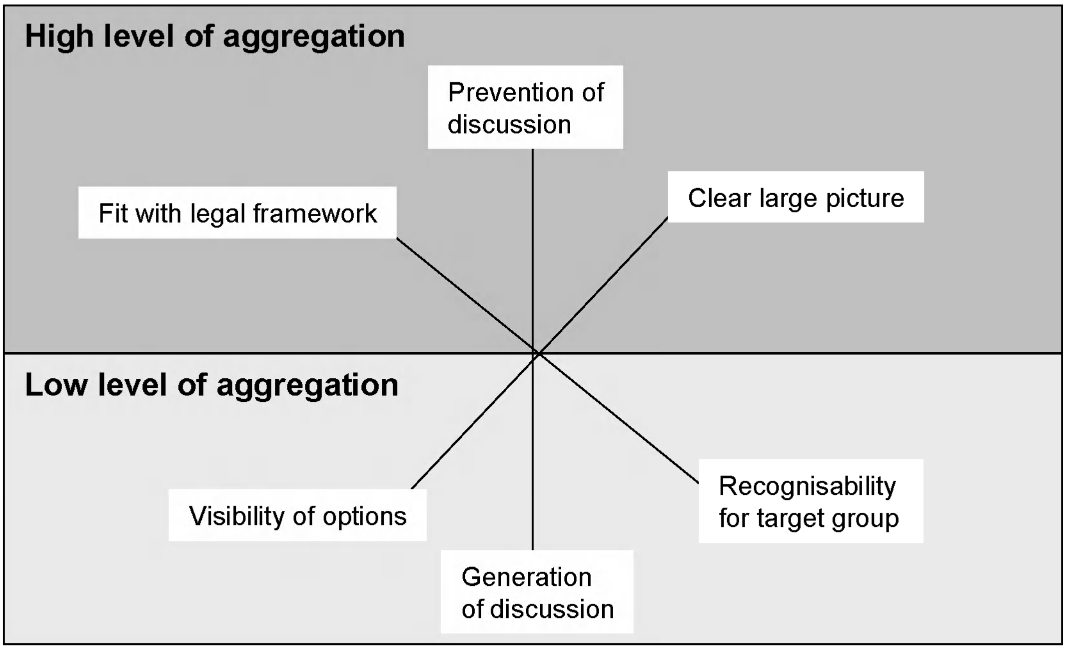


Figure 6.6: Tension bow diagram for selection of level of aggregation of the presentation of results in the WSS from the perspective of the policy analyst

6.4. Scale handling during the WSS-project

6.4.1. Spatial boundaries

From the start of the project, lots of attention was given to interactions between the different spatial scales. Especially during the kick-off meeting and the first workshops organised during the project, several discussions concerning this issue took place.

Discussions to involve the upstream areas
The influence of international developments and upstream measures was recognised by the initiators of the study and discussed during the kick-off meeting in which a lot of political

actors participated. Every change in the discharge situation upstream would have consequences, positively or negatively because of the downstream location of the Netherlands of large international rivers such as the Rhine, the Meuse, and the Scheldt (RIZA, 2001). The influence of the water discharge of the Meuse, especially, was considered to be of huge importance. In the current situation, agreements with Belgium existed on the minimum discharge of the Meuse at the state boundary. Although this was mentioned in the project plan, no consequences were attached to it nor was it mentioned how it would be taken into account in the study. During the first workshop it became clear that a number of actors really wanted to address this issue. It was decided that it was impossible to involve the upstream countries in every action and it was considered important to find a balance.
At certain times, the upstream countries needed to be involved, for example in the construction of scenarios for river discharges and when discussing solutions upstream (Luiten, 2001). Limburg and Zeeland repeatedly lobbied for taking upstream countries into consideration in the analysis and the search for policy options. On the international scale, the involvement of Belgium and Germany was discussed. Their involvement seemed required in order to make a good estimation of river discharges entering the Netherlands. It was considered important to know how Germany and Belgium were dealing with water shortage situations now and in the future. They might, for example, be considering storing water in reservoirs which results in a lower discharge at the boundary of the Netherlands. These possible policy changes were not yet taken into account.

Discussion to switch to the regional scale

At the end of Phase 1 it became clear that the only option that was present on a national scale was an adjustment to water distribution at the sluice of Driel/ Hagestein. In the evaluation workshop after Phase 1, the selection of scale for the design of policy options was discussed. The question was raised by a national political actor whether to continue with the Water Shortage Study on a national scale or to switch to the regional scale because it was clear at that time that the main part of the policy options to be designed was thought to be present at the regional scale. Effective measures could therefore only be suggested by regional actors in regional studies. Still, the national scale was used in Phase 2 for analysis, considering the fact that regional solutions often have an impact on a larger scale than the scale of the solution itself. The design of policy options was done in close cooperation with the regional actors.

Discussion to involve regional scale in impact assessment

The national approach raised the question of what spatial scale to evaluate the impacts of the policy options on: national, regional or both. It was thought to be very difficult to determine the impact of generic measures because the link with the regions was considered to be a crucial factor. For example, one of the suggested measures was to lead more water to the northern parts of the Netherlands during water shortage situations. This, however, might result in salinity problems in the western part of the country. On a national scale this measure can be judged as fair: on a regional scale, good in the northern part and bad in the western part. Another example: planning to store water in reservoirs would be a useful solution in the upstream areass of the river, but the downstream areas would have a larger problem in that case (taking into account implications of measures at different levels of scale). Finally, it was decided to focus on the national scale and evaluate impacts on the regional scale in regional studies.

Shift to regional scale in the finishing up

At the end of Phase 2, a large shift towards regional scales took place. The policy analysts felt that the Water Shortage Study had stimulatied the regions to start their own studies. The developed national models gave the regions an instrument to judge the measures to be taken in a larger context than their own scale did.

During an interview held at the end of the study, a commissioner of the study put the coupling between the different scales into discussion:

> *The coupling between the different scales was not good enough in my opinion. The regional commitment was limited and it took a long time before the regional studies got started. I was also not pleased with the coupling to the larger spatial scales because the study does not sufficiently show what the important relations with the higher spatial scales are.*

In the WSS, for the spatial boundaries, a distinction can be made between five spatial scale-related rounds that are described in Table 6.11.

Table 6.11: Water Shortage Study in spatial scale-related rounds

Spatial scale related rounds	Description	Date
I: Modelling for problem assessment	The objective of the study in Phase 1 could be classified as research and analyse. Spatial scale choices were made in that respect, so a national assessment was done that made it possible to include meteorological droughts.	June 2001- June 2003
II: Re-discussion of spatial scale choices in between Phases 1 and 2	During the evaluation workshop after phase 1 some actors involved started the discussion whether phase 2 of the study should be executed on a regional scale, because the solutions appeared to be mainly present on a regional scale.	June 2003- September 2003
IV: Searching for options closely involving regions	Continuing on the national scale but involving regional actors closely by round-table discussions	September 2003 - June 2005
V: Shift to regional scale in the finishing up	Large-scale infrastructural solutions on a national scale appeared not to be cost-efficient, so a shift in focus from the national to the regional level could be observed.	June 2005- September 2005

6.4.2. Temporal boundaries

Besides 2015 and 2050, 2005 also became a point of attention in the study soon after the start. The involvement of this short term that reflected more or less the current water shortage situation had two reasons. First, an estimate had to be made of how much money was needed to reduce the problems before the elections in 2006 because, then, the budget would be set. And, input on the current water shortage situation was needed by the National Policy Agreement-Water which would appear in 2005. Also, the water shortage problem as it was present at the time of the study itself appeared already difficult to assess. A national policy actor argued that the reason was the uncertainties in the assessment of the current situation. Therefore, in meetings at the start, the long term got less attention than the current situation.

In the interviews held after the study, there seemed to be some disagreement between the actors about which temporal boundaries gained more attention during the study. Looking back at the study, different opinions existed about the emphasis on time scales: some actors stated that the different time scales got an equal amount of attention, other actors stated that 2050 gained more attention during the study while other actors stated that 2015 gained more attention. All actors agreed that, in the beginning, 2050 played an important role because climate change was the main starting point. At first, 2015 gained less attention because from the perspective of climate change it was thought to be very close to 2005. The emphasis on temporal boundaries shifted during the policy analysis process according to some actors involved. Several events played a major role in this shift, according to them: the water shortage of 2003, the appearance of the climate scenarios of the KNMI and the understanding that regional solutions were needed. At the end of Phase 1, a shift took place to 2015 because of the water shortage event in the summer of 2003 that caused a significant increase in the urgency of the problem and in the need for short-term solutions. Also, the conclusion was drawn that current problems and future problems were thought to be quite similar. The climate scenarios of the KNMI that showed that the water shortage situation in the future would be only a few percents worse than now contributed to that decision. When, during Phase 2, it became apparent that huge infrastructural investments were not considered a serious option and that climate change and economic scenarios were very uncertain, more and more emphasis was put on 2005 and 2015.

Looking back at the study, a political actor said:

> *The distinction between the different time scales faded a little during the study. This was caused by the fact that the current situation is a good starting point. The problems appear not to be extremely larger in the future.*

When the new climate scenarios of the KNMI appeared in September 2004, again a shift could be noticed. These scenarios gave a completely different result than the earlier ones. The KNMI concluded that the climate change effects would be noticeable sooner than first expected. They showed that a big change might occur because precipitation decreases (in contradiction to earlier scenarios that said precipitation would increase) and evaporation increases. This compromised the earlier assumption that the situation now would be comparable to the future situation and led to greater emphasis on the long term. Looking back, a researcher concluded that these events and shifts in focus also show that the multi-scale analysis that was used in the study was a good starting point.

In the WSS, for the temporal boundaries, a distinction can be made between three temporal scale-related rounds that are displayed in Table 6.12.

Table 6.12: The Water Shortage Study in temporal scale-related rounds

Temporal scale-related rounds	**Description**	**Date**
I Long-term orientation (emphasis on 2050)	Climate change was thought to cause more frequent and more severe water shortage situations	June 2001-August 2003
II Switch to short term (emphasis on 2015)	Water shortage incident of 2003 and big uncertainties in climate scenarios	September 2003-September 2004
III Switch to long term (emphasis on 2050)	New climate scenarios show a faster change in the climate than expected, so in 2050 effects were likely to be noticeable	September 2004-June 2005

6.4.3. Level of aggregation

Level of aggregation of the modelling study

During the study some critical remarks were made concerning the low level of aggregation. Already during the first workshop at the start of the study, many different opinions on the desired amount of detail appeared to be present. An ecologist made a plea for a more detailed analysis of ecology by arguing that nature gradients are very important and have to be studied more closely to provide any useful information. A regional water manager objected that the partial river basins would provide a sufficient amount of detail. This led to intense discussions. It was decided to make the studies at the appropriate level of aggregation for each function. During Phase 1 of the WSS on several occasions, the policy analysts and some of the hydrologists recommended elaborating on a process model for a small area to gain insight into the processes that played a role and the parameters that played a key role. This recommendation was not taken up.

In the evaluation workshop after Phase 1, a political actor involved noted that the risk existed that the Water Shortage Study would become too complicated and too detailed to be able to communicate the results very clearly. He suggested in the evaluation workshop after Phase 1 of the study that a different level of aggregation was needed to discuss the water shortage problem than what was needed for the problem assessment.

> *In WB21 'retain-store and discharge' is quite a popular concept. The idea behind this slogan is simplistic and non-shaded, but it is easy to communicate and everybody in the water world knows about it. In the communication of difficult problems, like water shortage, the risk exists to get too detailed. Simple concepts appeal more to people than difficult detailed descriptions. To be able to put the problem on the agenda, you have to keep it simple.*

Also, the differentiated level of aggregation received some criticism during the evaluation workshop held after Phase 1. A political actor considered the use of different levels of aggregation to be a weakness during the evaluation workshop. He concluded that the tendency existed to research issues in depth on which knowledge was already available:

> *A lot of detailed attention was present for issues that are already known while little attention was given to aspects that are not known, such as saltwater intrusions for example. From a managerial perspective this was not very efficient.*

In the evaluation after Phase 1, it was concluded that the amount of detail used in the modelling and the large number of models made it difficult to assess the effects of measures quickly. The question to be asked, according to the commissioner of the study, was how to translate the study from a research endeavour to a study that supported policy making. One of the questions he thought relevant was what to do with the heavy set of model instruments containing many not-so-relevant details. The set of model instruments was even addressed by many as the 'modelling train' because of the interdependencies between all models. Because policy support was an important objective of the models in Phase 2, a lot of effort was put on making the information that was present in the models more useable by a larger audience by aggregating the results. This finally resulted in a website.

The water shortage situation in the summer of 2003 caused a large increase in the urgency of the problem and in the need for action. The behaviour of the researchers involved who wanted to assess the problem in more depth was less appreciated in this phase. According to one of the policy analysts involved, the researchers had great difficulty with the phrase *sufficient knowledge for making decisions*.

> *The researchers always want to know in more detail what the problem is. They seem to keep busy with the problem analysis, trying to know in more detail how everything works. They are studying the influence of water shortage on recreation at the moment, while we are interested in the effects of policy options on water shortage.*

This is a good example of a conflict of interests: the researchers wanted to investigate the problem at great length (research and analyse) as opposed to the policy analyst who focused more on the design and recommendations, wanting to know what the impact of solutions was to be able to evaluate the measures. In case of a critical situation the political actors also became more anxious to get results and recommendations fast.

Level of aggregation of the presentation of the results

The level of aggregation of the presentation of the results dealt with a selection that was made more or less at the end of the study, while the other scale choices were made at the beginning. During the study, however, on several occasions, the interim results were presented. Some of these occasions are highlighted here to show the diversity of levels of aggregation that were involved in the presentation and the diversity of reasons that may have played a role in the selection of the level of aggregation even during one project. Generally, it could be noticed that during the study, a low level of aggregation was selected to generate discussion during the study.

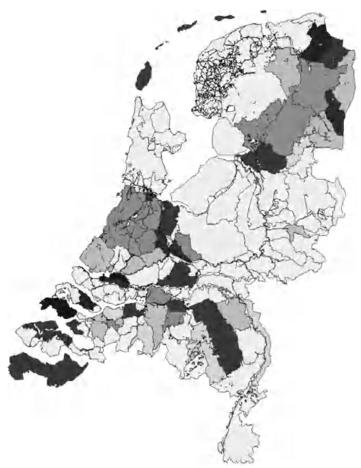


Figure 6.7: Map of water shortages in an extremely dry year presented during Water Shortage Day, November 5, 2002 (Source: Durk Klopstra, HKV)

A map showing the water shortage situation in detail (130 districts) was presented during the third water shortage day, halfway through Phase 2 (see Figure 6.7). It was known beforehand that this would result in a lot of discussion. Because of the large amount of detail present, the regional actors felt they could contribute to the discussion and had the feeling that their reaction mattered. People from the regions were the only ones able to judge the accuracy of the results, if the results were recognisable to them. This worked out very well, because one of the regional actors in Zeeland immediately questioned the results for locations in Zeeland based on his experience. The downside was that because a lot of people started questioning the results the feeling of reliability of the models decreased.

Also, the preliminary results were presented to the individual water boards on an even lower level of aggregation (using the 500 x 500 metre modelling units). This was done to give the people from the water boards insight into how the models worked and what the function was of the data that the water boards provided. It was thought that the water boards would put more effort into delivering the right data and checking the results if they had better insight into the model.

A policy analyst, looking back on the low level of aggregation of the modelling, noted:

> *I agree that modelling studies are often executed in more detail than the level on which the actual decisions are made, but in this case the modelling has been executed at three levels of aggregation more detailed than the decision-making process. When you also see that in the process of drawing the conclusions little has been done with the modelling results, I think we have to conclude that the study has been executed on too low a level of aggregation.*

Level of aggregation in rounds

In the WSS, for the level of aggregation, a distinction can be made between three level of aggregation-related rounds that are shown in Table 6.13.

Table 6.13: Water Shortage Study in rounds related to the level of aggregation

Scale-related rounds	Description	Date
I: Initiation of the study	First, a high level of aggregation was selected for pragmatic reasons. Information had to be delivered to the National Policy Agreement-Water group on the water shortage problem. This information was limited to 20 lines of text.	June 2001-December 2001
II: Modelling for the problem assessment	The objective of study in Phase 1 could be classified as research and analyse. The low level of aggregation for the models was made in that respect. The study was a follow-up of the PAWN study. In this phase it appeared to be difficult to get regional actors involved because many didn't feel dedicated to a study on a national level. Also, it appeared to be difficult to get political actors involved because governmental relevance is limited. The problem was assessed at the end of Phase 1 of the study but the balance was missing somewhat. In Phase 2 modelling on the low level of aggregation continued.	December 2001-June 2005
III: Shift in level of aggregation in the finishing up	The level of aggregation in the presentation of results became a discussion point. The regional actors were quite happy with the detailed models developed because the results were recognisable to them. The national political actors, on the other hand, thought it was necessary to present the results at a higher level of aggregation as well.	June 2005-September 2005

6.5. Results

The main conclusion of the Water Shortage Study of the Netherlands was that large-scale infrastructural measures to change national water distribution were not needed because none of the possible measures was thought to be cost effective. The results of the WSS were also a reconfirmation of the results of PAWN: the water management system in the Netherlands is still in good shape, there is no need for significant changes. An important product of the study was the new priority setting that is outlined in Table 6.14.

Table 6.14: Priority setting *(verdringingsreeks)* between competing interests in water shortage situations at the end of the study (Ministerie van Verkeer en Waterstaat, 2005b)

1 Safety and preventing irreversible damage	**2 Utilities**	**3 Small-scale high quality use**	**4 Other interests**
• Stability of water weirs • Subsidence (peat) • Nature (related to soil conditions)	• Drinking water supply • Energy supply security	Prevention of large damage from little water • Irrigation of capital-intensive crops • Process water industry	Economic and societal balancing, for example: • Shipping • Agriculture • Nature • Industry • Water recreation • Fishery Water goes to the region or sector where the largest (societal) damage can be prevented

One of the important by-products of the study that was not anticipated at the start was a website that made the models and the information gathered during the project available to the regional actors and to the public.

A regional actor commented:

> *It is surprising to see that not a single water board has made a claim in the process that they wanted more water. This shows that actors have a lot of understanding for each other's situation. Another reason may be that the water world is organised in a hierarchical way.*

The study resulted in two reports: an overview of the water shortage situation and a water shortage assignment. The water shortage assignment was an estimation of the water shortages for which options were thought feasible.

The end of the total project was initially estimated to be December 2003, but it finally ended in July 2005. Three reasons were present for this long delay. The first reason was the extensive modelling effort in Phase 1. In Phase 2, the modelling activities were continued to assess the nature component, the size of the problem in detail, and to optimise the models. The second reason for the delay was the water shortage situation of 2003. RIZA's project leader and the researchers had to spend a lot of time on the evaluation of that problem, on priority setting, and on norm setting. It also became more urgent to design policy options to solve the problem, but other activities that were not originally planned got in the way of the WSS. This was very harmful to the progress of the project. On the other hand, the water shortage situation contributed heartily to the objective of placing the problem on the agenda. A third reason for the delay was the large involvement of the Governmental Column in Phase 2 that was not organised very efficiently. In Phase 2, in which solutions were studied more closely, the decision makers participated more actively. According to the analysts, the 'column' of policy makers was not very firm in their decisions. For example, a lot of time was spent on the discussion about norms while later it was decided to drop this issue.

The decision not to change the national distribution was made almost two years after the 2003 water shortage situation. The main message was that the regions had to take the next step and start their own studies and take their own measures. This created a feeling of disappointment in many regional actors. A provincial representative felt that the problem was shifted to the region really easily, all of a sudden. Another representative of the provincial government mentioned that he was quite disappointed by the result of the study and had expected more results. A water board representative thought it was easy to say that the regions have to solve the problem themselves. Another water board representative was not surprised, however, because this was the only possible conclusion in his opinion, but he thought that a lot of time had been needed to draw this simple conclusion.

6.6 Aftermath

Regional scale at play!

A lot of effort was made to motivate the regions to start their own regional studies. It was clear that the regional actors were at play in the follow-up. With a number of actors, their expectations for the follow-up were discussed. Most of them expected that the regions would start to make an inventory to assess their own regional problems. A few actors responded that not too much was to be expected, no extensive studies would be done, especially not after the conclusions of the Water Shortage Study of the Netherlands. It could be expected that water shortage would be taken into account in the line of the water assignment. Some water boards were afraid that by starting their own studies they might wake sleeping dogs that did not realise there was a problem. So this might stir things up.

In 2006, new climate scenarios of the KNMI were published. In 2008, therefore, a second water shortage study was started to update the results of the first one, in light of those new scenarios. Also, input had to be provided for the National Water Plan.

Discussion on the level of aggregation of the modelling instrument

After the study the feeling grew that the modelling instrument was not a real decision-support tool but a model of the physical processes that play a role. Although some researchers had the feeling that even more detail should have been involved in the models, it was increasingly recognized by political actors, policy analysts and also some researchers that the relationship to the policy questions asked was limited. Therefore, the plea was made to construct a simpler model to understand the processes that occur and to use the existing low aggregation models for a detailed impact assessment at the end.

7. Studying the effects of the spatial boundary setting

It is not very important for the outcome whether a few small villages are involved or not or whether the tributary rivers are involved or not. Determining for the outcome is whether Zeebrugge is involved. ...I do not expect that it would have mattered for the content, but it would have added to the tension and therefore it might have delayed the process.

-Pers. com. Political actor against the deepening, Long-Term Vision of the Scheldt Estuary, 2004

I do not understand why, in water flooding studies, upstream countries tend to get involved and in the Water Shortage Study they don't. I see as many reasons to involve the upstream countries in the water shortage problem as well.

-Pers. com. Regional political actor, Water Shortage Study, 2005

7.1. Introduction

In this chapter, the effects of the spatial boundary setting are studied using the two cases that were introduced in the previous chapters: the Long-Term Vision of the Scheldt Estuary (LTV) and the Water Shortage Study of the Netherlands (WSS). The main goal is to look more closely at what the effects of the spatial boundary setting are in practice.

In the LTV, the deepening of the waterway appeared to be a very controversial issue with a lot of conflicting preferences and also big consequences for the options being considered. The spatial boundary setting of the *analysis scale* was studied to see how the spatial boundaries contributed to placing the deepening issues central on the agenda.

In the WSS, the selection of the spatial boundaries was made quickly because the institutional scale was automatically selected as the scale. However, this turned out to be a delicate issue that was discussed regularly during the study because the problems manifested themselves mainly on the regional scale and a lot of interaction between the regional, national and river basin scales were required. Therefore, the spatial boundary setting of the *analysis scale* was studied during the WSS as well.

Key questions:

- *How does one select spatial boundaries in such a way that an urgent problem is central on the agenda?(LTV)*
- *How does one deal with cross-scale interactions?(WSS)*

In the sections that handle the case studies, first the selected spatial boundary is analysed by constructing a system diagram in which the variables taken into account, the exogenous factors, options to be included and the outcomes of interest, are examined. Also, an actor analysis diagram is constructed in which the dedication and criticalness of the actors involved is indicated and explained. Next, a thought experiment is conducted in which alternative spatial boundaries are discussed. The alternative spatial boundaries are plausible alternatives that at least one of the actors involved mentioned as an interesting alternative. The results of the thought experiment are described in two parts: a value free part presenting the system diagram and the actor analysis diagram for each alternative spatial boundary, and a part in which values are given to present the actor perspectives.

To make the diagrams, the system diagram and the actor analysis diagram of the selected spatial boundary were always used as a starting point. The differences between the system diagram and the actor analysis diagram of the selected spatial boundary are clearly highlighted.

In the system diagrams of the scale alternatives, changes compared to the original system diagram are presented as follows:

- Additional variables, options and arrows are marked in **bold**
- Variables, options and arrows that do not play a role are marked in grey

In the actor analysis diagrams of the scale alternatives, changes compared to the original actor analysis system diagram are presented as follows:

- New actors are marked in italics and underlined
- Actors who changed positions (dedicated, critical) are marked in italics

The data are based on interviews with actors involved, and on my own observations and analyses. Also, the actors' perspectives on the different alternative spatial boundaries are presented; these are solely based on the interviews with the actors involved.

Next, the most important observed effects of the selected spatial boundaries are summarised. These types of effects were observed by the actors involved and by me. To prevent the list of effects to become a heterogeneous list of all kinds of effects, a causal diagram was constructed in which tentative causal relationships between the type of effects were drawn.

The last section of the chapter shows a cross-case comparison in which results from the two case studies are compared and the similarities and differences are explained. Finally, a reflection is given on the key questions that are presented above.

7.2. Long-Term Vision of the Scheldt Estuary

7.2.1. Analysis of the selected spatial boundaries

As presented in Chapter 5, the selected spatial boundary of the study was defined as the Scheldt Estuary from Ghent to the North Sea, including the banks and the mouth, excluding the tributary rivers and channels. At this spatial scale, the deepening of the waterway was the main focus on the agenda. Figure 7.1 presents a map of the selected spatial boundary.

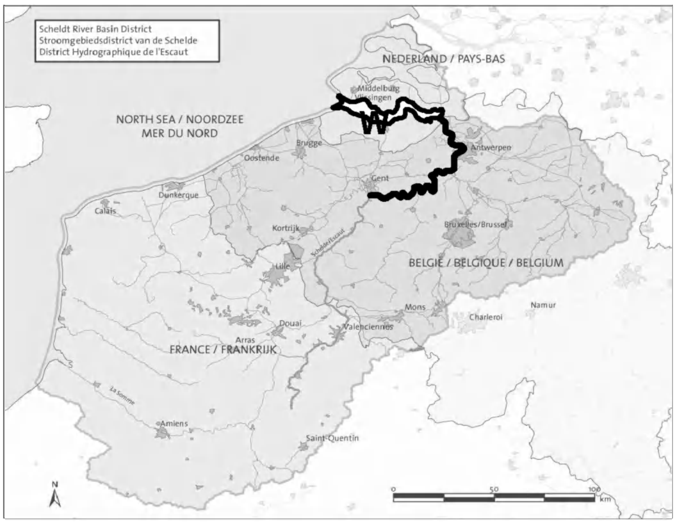


Fig. 7.1: The Scheldt Estuary excluding the tributary rivers (map adapted from http://www.scaldit.org)

Systems analysis

To be able to construct a system diagram, it is important to understand the significant processes and variables that play a role. The processes that played an important role were already identified in Section 5.2.3 as being morphological, ecological, and economic processes and those processes that concerned safety. In this section, the variables that played a role in the system diagram will be identified.

- *Morphological processes:* The deepening would probably lead to an increase in current velocity, resulting in a higher dynamics. The choice to preserve the multi-channel system was thought to have effects on estuary management. No limitations for the deepening were to be expected but strict limitations were present for the sediment dumping strategy. Dumping the sediments that were dredged during the deepening activities was not possible within the system because of the risks of disturbing the dynamics of the system.
- *Ecological processes:* Naturalness demanded a system that was not contaminated and had a large variety of dynamics and space that would result in a diversity of habitats. The dynamics could not be too high because then the shallow and calm areas would erode and banks could get steeper. The increase in current velocity caused by the deepening could be compensated by creating more shallow areas near the shore to dissipate the energy. One of the other important demands to realise a healthy ecosystem for the Scheldt Estuary was the improvement of the water quality by reducing the amount of contaminants. Water quality was still a limiting factor for many functions of the system. The water quality could only be improved if less organic material and nutrients were discharged in the entire Scheldt River basin (from Deckere and Meire, 2000 and pers. com. Van Damme, September 2004).
- *Economic processes:* An increased depth of the Western Scheldt would improve Antwerp's accessibility and would allow more ships to enter the Port of Antwerp each day without delay. This was expected to contribute to Antwerp's economy and thereby, also, the economy of Flanders.

- *Processes concerning the safety:* The number of ships on the Western Scheldt negatively influenced safety because the presence of more ships was likely to cause more accidents.

In Figure 7.2, these processes are presented in a system diagram. The line drawn around the options indicates that the options are not separate but are closely linked to each other. If the navigation channel were deepened, nature compensation measures would have to be taken and a sediment strategy would have to by made.

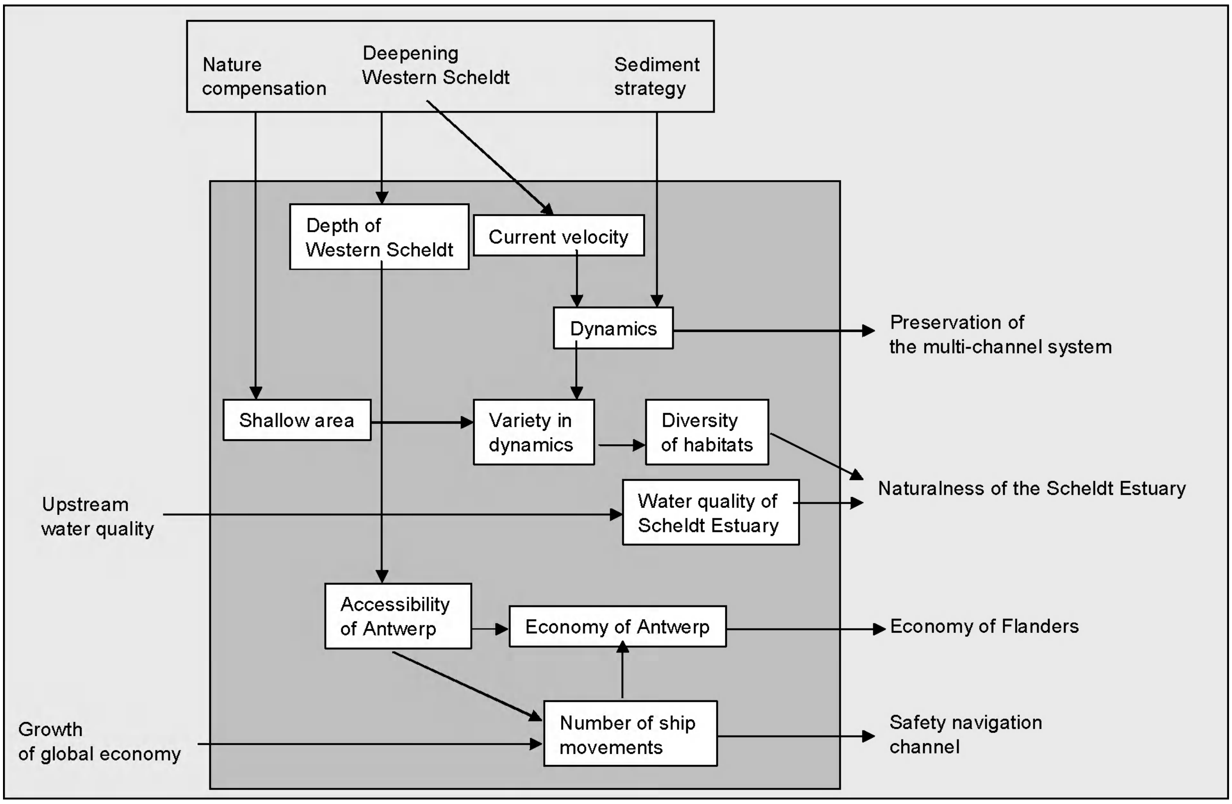


Figure 7.2: System diagram of the Scheldt Estuary excluding the tributary rivers, LTV

Actor analysis

All actors involved were dedicated to the problem of the deepening that was central on the agenda at this spatial scale. They all recognised the importance of the problem and the necessity to solve it. Not all of the actors, however, were critical in the sense that they needed to be included in order for the problem to be solved. Table 7.1 gives an overview of the results of the actor analysis. Most governmental actors were considered to be critical except for the regional and local governmental actors. This was also related to the high level of aggregation that was used in the problem analysis: the national governments were at play. However, as described in Chapter 5, the Dutch Ministry in The Hague was not closely involved; it delegated the issue to the regional directory of RWS (Directorate of Zeeland). The Directorate of Zeeland represented the Ministry so could still be regarded as a national actor. Most stakeholders were not considered to be critical except the Port of Antwerp. Although the Port of Antwerp was a local actor, it was considered to be critical on such a large scale because of the port's large influence on the economy of Flanders. Also, the Port of Antwerp was considered to have a big influence on the national media.

Table 7.1: Actor analysis diagram of the Scheldt Estuary excluding the tributary rivers, LTV

	Critical actor	Non-critical actor
Dedicated actor	Dutch Ministry of Transport and Water Management Ministry of the Flemish Community Port of Antwerp	AMINAL Technical Scheldt Commission Province of Zeeland Municipalities in Zeeland Agricultural organisations Tourism organisations Nature organisations
Non-dedicated actor	-	-

Actor perspectives
The coherence and representation of the themes ecology, morphology, safety and economy are mentioned as major arguments in favour of the selected spatial boundaries by the political actors and the commissioner. Governmental coherence (the fact that there is one initiator: the Technical Scheldt Commission) was an important argument in favour of this alternative that was mentioned by the policy analysts. The economist thought it was good to focus on the Scheldt Estuary without the tributary rivers. The four ports along the Scheldt, Flushing, Terneuzen, Antwerp and Ghent could be taken into account when using these spatial boundaries.Other arguments mentioned in favour were feasibility, workability and the match with the EU Framework Directive -Water.

The contradiction in preferences for spatial boundaries between the political actors in favour of and against the deepening became apparent in the discussion of this alternative: the actor in favour of deepening wanted to limit the study even further because he still had the opinion that issues awere included that were not part of the problem while the actor against the deepening thought that no balanced package was possible when these limited spatial boundaries were selected. Another argument that was mentioned against this scale was the fact that the natural system exceeded those boundaries.

For a complete overview of all the criteria mentioned in favour of and against the selected spatial boundaries, refer to Appendix 5.

7.2.2. Thought experiment

Design of the thought experiment
Many alternatives were present for the spatial boundaries. In the thought experiment, five alternatives are discussed which are mentioned in Table 7.2. The concept of the thought experiment was explained in section 4.5.2.

Table 7.2: Alternatives studied in the LTV spatial scale thought experiment

Larger spatial scale	Smaller spatial scale
1. Scheldt River basin	5. Western Scheldt
2. Scheldt Estuary including the tributary rivers	
3. Scheldt Estuary including the Channel of Ghent to Terneuzen	
4. Scheldt Estuary including Zeebrugge	

The Scheldt River basin and the Scheldt Estuary including the tributary rivers were mentioned as alternatives by the ecologists. The Scheldt Estuary, including the Channel of Ghent to Terneuzen, was mentioned as an alternative by the political actors against deepening. The Estuary including Zeebrugge was discussed during the scale decision-making process and is mentioned by Roos et al. (2000) and Leemhuis-Stout (2001). The Western Scheldt was selected in previous studies.

Results of the thought experiment

1. Scheldt River Basin

Systems analysis

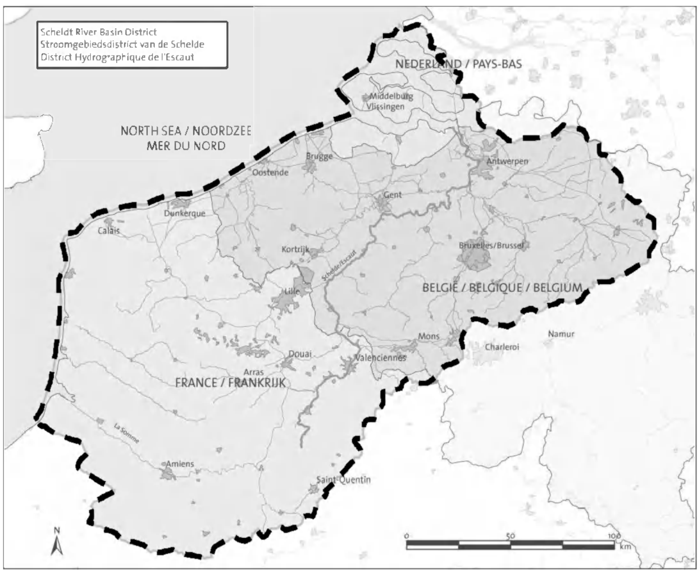


Figure 7.3: Scheldt River Basin (boundaries indicated by dotted line) (map adapted from http://www.scaldit.org)

The boundaries of the ecological system do not coincide with the selected scale of the Scheldt Estuary. Upstream water quality has an important impact on the ecological system in the downstream estuary. Water quality issues, however, did not fit the selected scale but played out over the entire river basin. Many pollution sources are located in upstream parts of the Scheldt. At river basin scale, it was possible to include water quality in the study and study the ecological system of the Scheldt river basin in an integrated way. In the system diagram, upstream water quality was no longer an exogenous factor because it was part of the system. Also, options to improve the water quality came into the picture, like clean-up measures by industry in the river basin area. Because the deepening was the main reason for the study, it is unlikely to think that by choosing these boundaries the deepening would not be an issue of discussion. However, other issues also became more central on the agenda. In the system diagram, that is not recognisable because no distinction was made in the priority of the issues involved. Figure 7.3 presents a map of the river basin and Figure 7.4 shows the system diagram of the basin.

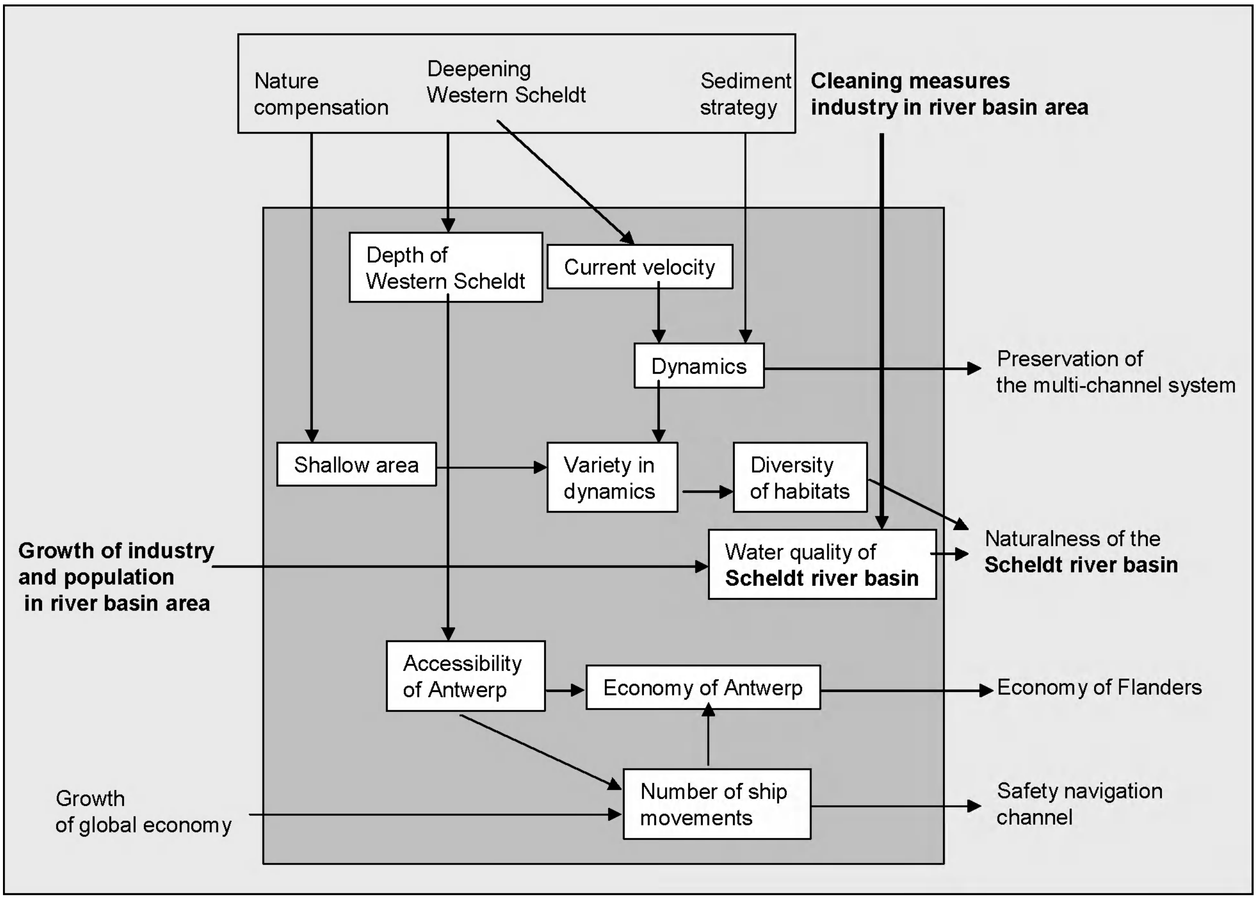


Figure 7.4: System diagram of the Scheldt River Basin, LTV

Actor analysis

Table 7.3 shows an overview of the results of the actor analysis. Some differences exist, compared to the actor analysis diagram of the selected scale:

- The Technical Scheldt Commission would have no interest at this scale so they were expected to be non-dedicated.
- AMINAL was expected to be critical at this scale because water quality would become an important issue.
- Other government actors would come into play: the French government, the International Commission on the Protection of the Scheldt River (ICBS) and the tributary river management organisations. The French government was expected to be non-dedicated because they did not have a large interest at stake, but critical because they could also take measures to improve the water quality. The others were dedicated but not considered critical because they did not have real authority in this matter.
- The industry in the river basin area that discharges contaminated water into the Scheldt was also expected to come into play as a non-dedicated but critical actor. In order to improve the water quality in the area, they would have to take measures to prevent pollution.

Table 7.3: Actor analysis diagram of the Scheldt River Basin, LTV

	Critical actor	Non-critical actor
Dedicated actor	Dutch Ministry of Transport and Water Management Ministry of the Flemish Community Port of Antwerp *AMINAL*	*Tributary river management organisations* *ICBS* Province of Zeeland Municipalities in Zeeland Agricultural organisations Tourism organisations Nature organisations
Non-dedicated actor	*French government* *Industry in the river basin area that discharges contaminated water into the Scheldt*	*Technical Scheldt Commission*

Actor perspectives

Almost all actors mentioned many arguments against the river basin alternative. Involvement of more actors and the risk of delay were the most frequently mentioned arguments against this alternative. Also, consensus building was considered to be more difficult than in the selected spatial boundary setting.

The policy analysts feared that the selection of the river basin scale would be at the expense of the depth of the study because of efficiency reasons. This relationship was also recognised in Section 3.3.3 (large scale, higher level of aggregation). The political actors were also afraid that upscaling might lead to a higher level of aggregation. The argument that was mentioned by the political actors was different from the argument of the policy analysts. The political actors thought that the quality of decision making changed when more actors were involved because discussions would become simpler and more recognisable for a large group. Therefore, a higher level of aggregation was needed.

A political actor in favour of deepening emphasised the difference in physical system characteristics between the Scheldt Estuary and the upstream part of the Scheldt when commenting on the river basin alternative. The morphologist agreed with the differencein the Scheldt Estuary and the upstream part of the Scheldt because the morphological system of the Scheldt is cut into two parts by the sluices near Ghent, creating a fixed boundary, so scaling up beyond these sluices of Ghent would be pointless.

The existence of other arenas in which river basin issues are addressed, like the International Committee for Protection of the Scheldt (ICBS), was mentioned by political actors and the commissioner as a major factor not to increase the spatial boundaries to the river basin.

The policy analysts thought that the loss of focus in the decision-making process was an important argument against the river basin alternative. A policy analyst noticed this:

> *The LTV mainly handles the position of Antwerp: can a top 7 port be maintained and develop itself in the estuary? The position of Antwerp and the accessibility of the ports would be snowed under in the debate on the environmental aspects between five different governments (France, Wallonia, Brussels, Flanders and the Netherlands).*

An argument that was mentioned in favour of the river basin alternative by the political actor against deepening and one of the commissioners was the possibility to involve the water quality issue. However, the political actor in favour of the deepening and the policy analysts mentioned the issue of water quality as an argument against the river basin alternative because it was such a delicate issue that was difficult to influence.

The fit with the EU Framework Directive-Water was mentioned as an argument in favour by the commissioners and the policy analysts. The ecologist considered the involvement of the upstream aspects very important from a systems perspective. He stated:

> *From an ecological point of view it is only advantageous to select the river basin. We always strive to look from source to mouth because what happens upstream has effects on the downstream part. Therefore, in this study I would have liked to include the upstream aspects.*

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 5.

2. Scheldt Estuary including the tributary rivers

Systems analysis

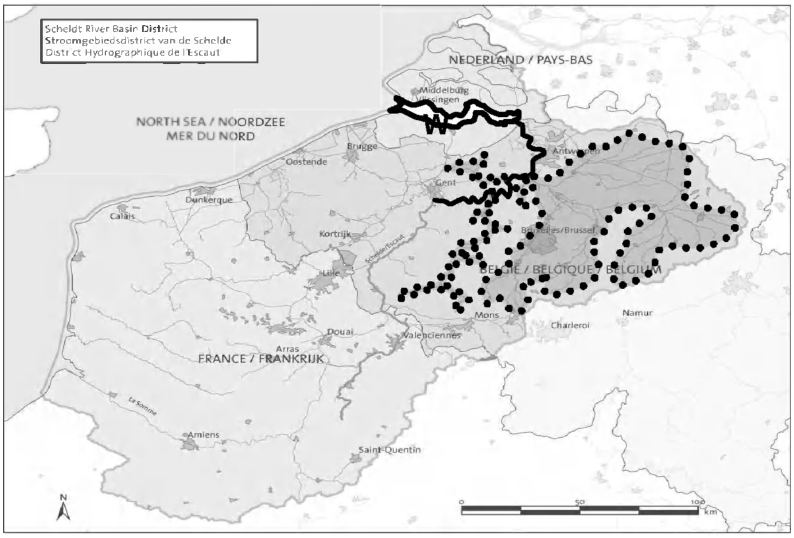


Figure 7.4: Scheldt Estuary from Ghent to the North Sea, including the tributary rivers(indicated by the dashed surface) (map adapted from http://www.scaldit.org)

The discharge of the Rupel into the Western Scheldt is larger than the discharge of the Upperscheldt because a large amount of water from the Upperscheldt flows into the Channel from Ghent to Terneuzen. This means that these tributary rivers have a significant influence on the estuary involving a lot of factors, for example the water quality. The system diagram is quite similar to the diagram of the Scheldt River Basin presented in Figure 7.2, but a few differences can be noticed. Upstream water quality has become an exogenous factor again because it falls outside the system boundaries. Also, the options for improvement of water quality are now limited to the tributary rivers area. Figure 7.4 presents a map of the Scheldt Estuary including the tributary rivers, and 7.5 the system diagram of the Scheldt Estuary including the tributary rivers.

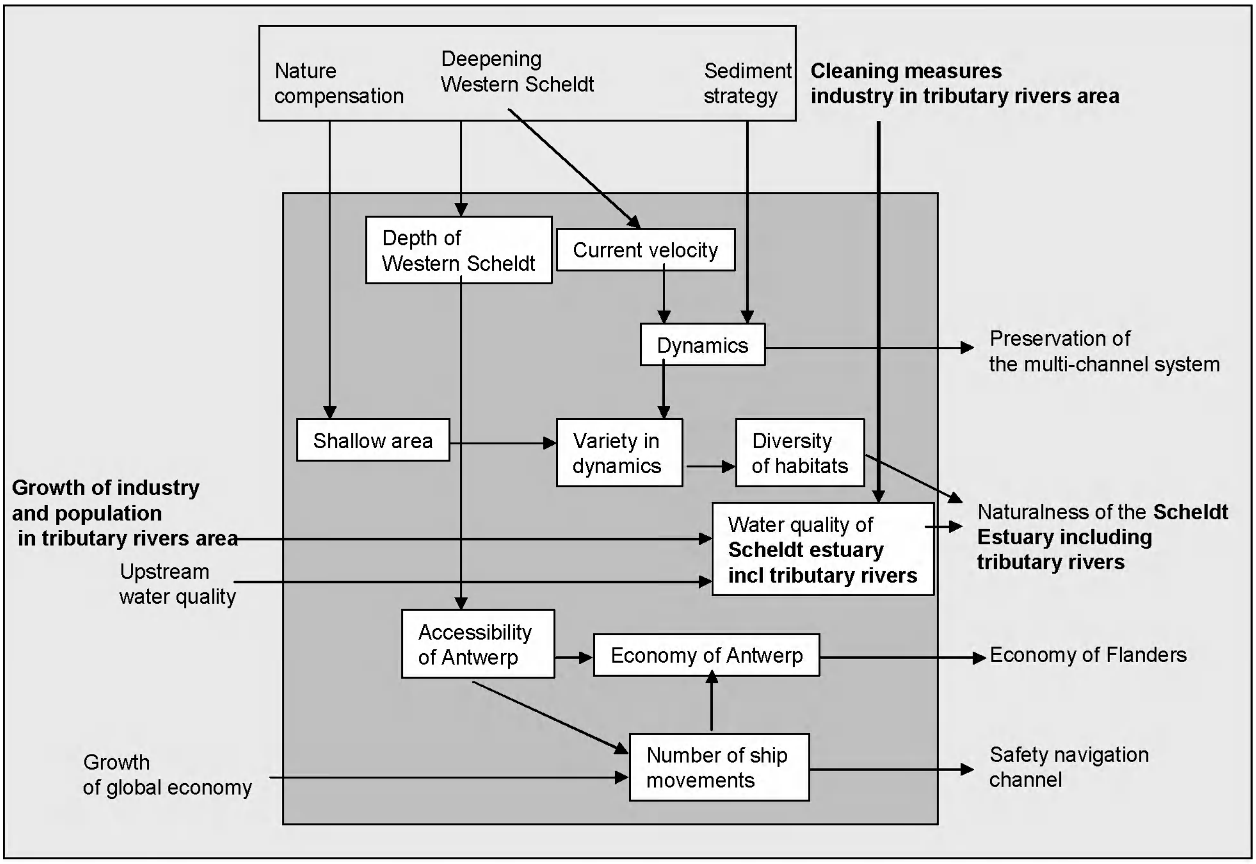


Figure 7.5: System diagram of the Scheldt Estuary including tributary rivers, LTV

Actor analysis

Table 7.4 provides an overview of the results of the actor analysis. Only a few small differences exist compared to the actor analysis diagram of the selected scale:

- AMINAL was expected to be critical at this scale because water quality would become an issue.
- The tributary river management organisations would come into play. They were expected to be dedicated but not considered critical because they did not have real authority in this matter.
- The industry in the tributary rivers area that discharged contaminated water into the Scheldt or the tributary rivers would come into play. This actor was expected to be non-dedicated but critical. In order to improve the water quality in the area, they would have to take measures to prevent pollution.

Table 7.4: Actor analysis diagram of the Scheldt Estuary including the tributary rivers, LTV

	Critical actor	Non-critical actor
Dedicated actor	Dutch Ministry of Transport and Water Management Ministry of the Flemish Community Port of Antwerp *AMINAL*	Technical Scheldt Commission *Tributary rivers management organisations* Province of Zeeland Municipalities in Zeeland Agricultural organisations Tourism organisations Nature organisations
Non-dedicated actor	*The industry in tributary rivers area that discharged contaminated water into the Scheldt or the tributary rivers*	-

Actor perspectives
The actors were slightly more positive about the Scheldt Estuary including the tributary rivers alternative than about the Scheldt River Basin alternative. Most actors agreed that it would be beneficial for the naturalness of the estuary to take the tributary rivers into account. Also, they were convinced it would be good for the naturalness of the tributary river areas as well. On the other hand, most actors thought that because the Dutch would get a say in Flemish matters it was a major argument against this alternative. This would be very sensitive from a political point of view. The difference in accessibility between the Scheldt and the tributary rivers was mentioned by many actors as a reason not to include the tributary rivers. Large parts of the tributary rivers are not accessible for ships at all. Also, only inland navigation takes place on the tributary rivers so no large container ships need to enter the tributary rivers. Therefore, the accessibility issue should not play a role in the tributary rivers. An important argument that was mentioned by the policy analysts against including the tributary rivers was that the commissioner of the study, the Technical Scheldt Commission, did not have authority over the tributary rivers. A commissioner mentioned a diversity of issues included as an argument to involve the tributary rivers. The commissioner explained himself:

> *That was beneficial because it made the Flemish realise that the world is not as one-dimensional as they wanted to believe. The Administration of the Scheldt was the shipping club, nature was not really an issue. We wanted to include diversity because we were used to work with diversity and because I knew that I could not get away with a one-dimensional solution in the Netherlands.*

According to a political actor, the need for involvement of regional actors was considered an argument against: this would lead to delay and less professionalism, according to him.

The inclusion of the tributary rivers was also considered to be a lesser option from a morphological perspective because, although the tributary rivers are relevant for transport of fine sediments, they are not important for the morphology of the estuary. Again, the ecologist regarded taking the tributary rivers into account as important because they had a large influence on the ecological system of the estuary.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 5.

3. The Scheldt Estuary including Zeebrugge

Systems analysis

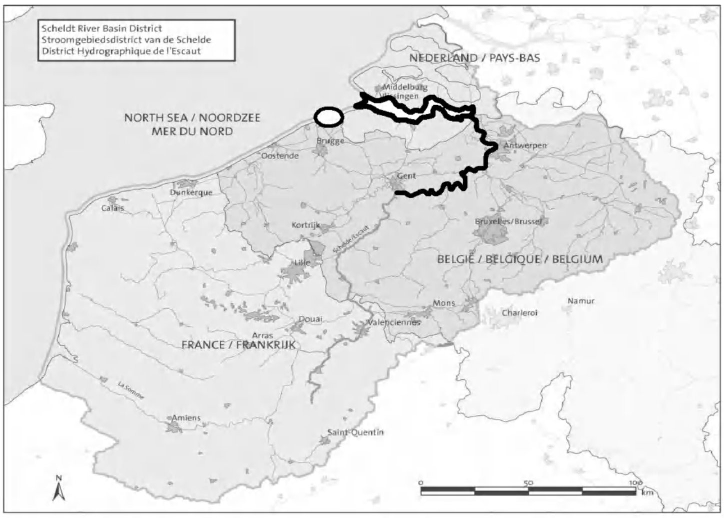


Figure 7.6: Scheldt Estuary including Zeebrugge (map adapted from http://www.scaldit.org)

Figure 7.6 presents a map of the Scheldt Estuary including Zeebrugge. The boundaries of the economic system do not coincide with the boundaries of the water system but extend into international systems for industrial production and trade (Verhallen et al., 2001). In these international systems many other ports are involved, like Hamburg, Rotterdam, London and Le Havre. Deepening the navigation channel would have economic effects on a larger scale than the Scheldt itself (for example on the Port of Rotterdam and the Port of Zeebrugge). In different background studies, it is stressed that from an economic perspective, it is important to consider a larger scale. In a second opinion study, it was concluded that from a transport- economic point of view it would be good to include the ports of Zeebrugge and Oostende in the design of policy options (Roos et al., 2000) because of the future advantages of sea ports. In this way more policy options besides deepening would come into view. A second plea for the inclusion of the sea ports was made in the consultation study during which interviewed stakeholders emphasised that, from a safety point of view, the trans-shipment of dangerous substances should, preferably, take place near the sea. (Leemhuis-Stout, 2001). This also pleads for scaling up and involving the sea ports in the search for policy options. If the Port of Zeebrugge would have been incorporated in the study, more options might have been present. Examples of the options mentioned in the study *Analysis of exogenous factors* (Resource Analysis, 2000) are the improvement of the existing channel connection between Zeebrugge and Antwerp (Pas van 't Zand), and the construction of a new channel between Zeebrugge and the Channel Ghent-Terneuzen. These solutions would have led to less shipping at the mouth of the Scheldt.

Figure 7.7 shows a system diagram of the Scheldt Estuary including Zeebrugge. An important difference with the system diagram of the selected spatial boundary setting is that the economy of the Port of Zeebrugge would become an important systems variable.

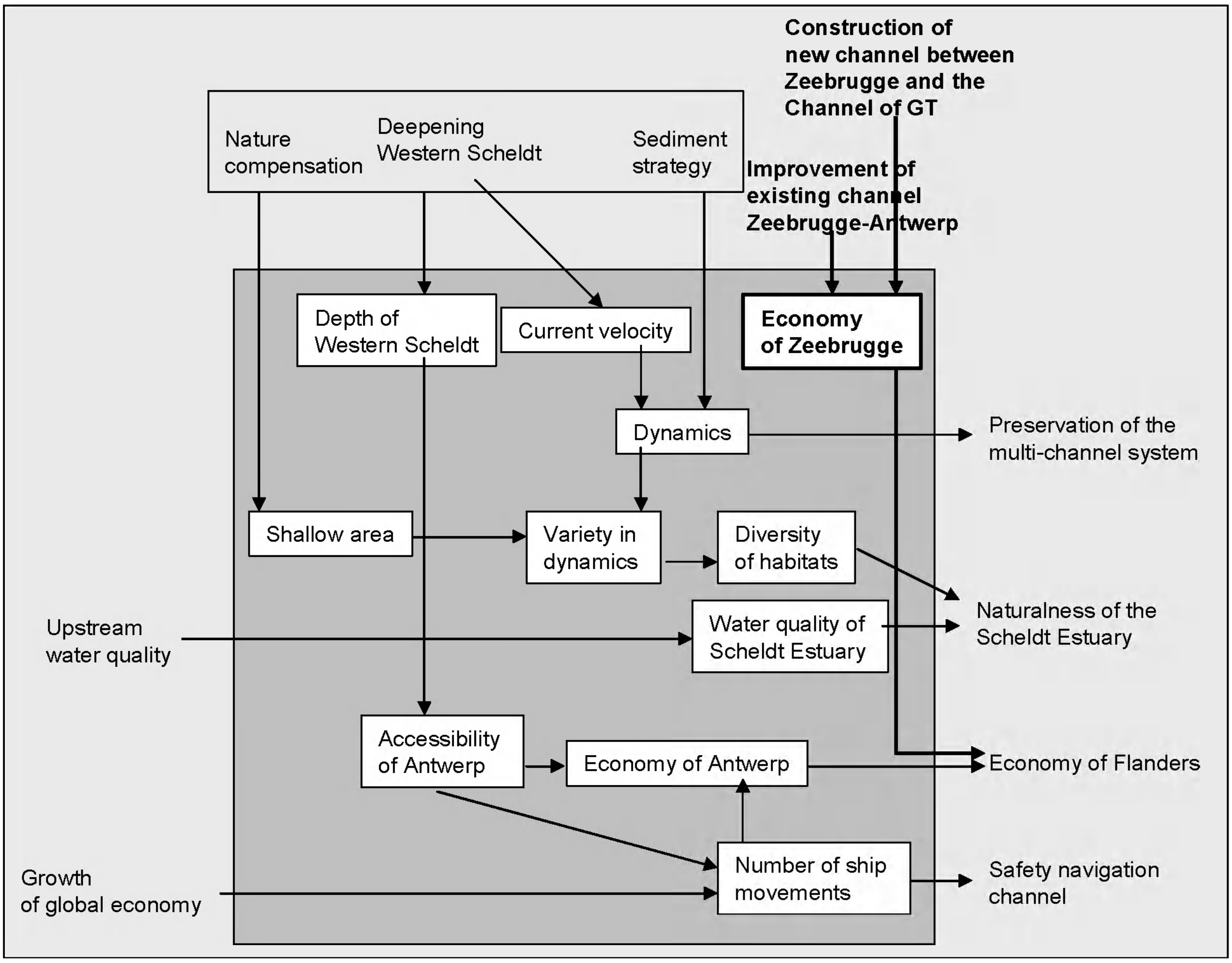


Figure 7.7: System diagram of the Scheldt Estuary including Zeebrugge, LTV

Actor analysis

Table 7.5 shows an overview of the results of the actor analysis. Only one difference exists compared to the actor analysis diagram of the selected scale: the Port of Zeebrugge has been added as a dedicated and critical actor.

Table 7.5: Actor analysis diagram of the Scheldt Estuary including Zeebrugge, LTV

	Critical actor	Non-critical actor
Dedicated actor	Dutch Ministry of Transport and Water Management Ministry of the Flemish Community Port of Antwerp *Port of Zeebrugge*	AMINAL Technical Scheldt Commission Province of Zeeland Municipalities in Zeeland Agricultural organisations Tourism organisations Nature organisations
Non-dedicated actor	-	-

Actor perspectives

The alternative *Scheldt Estuary including Zeebrugge* raised a lot of discussion, mainly because Antwerp and Zeebrugge were competitors and because this internal Flemish issue was, according to the Flemish, thought to be of no concern to the Dutch. Although all actors now realise that with hindsight the inclusion of Zeebrugge would probably not have provided an additional alternative, the thought that Zeebrugge might provide alternatives to deepening the Scheldt appeared to be present in a lot of people's minds at the start of the study. The political actor in favour of deepening literally called the alternative of including Zeebrugge too far from their goal. He thought that the inclusion of Zeebrugge would have made the project unnecessarily complicated and was afraid that projects would not have gotten started at all. On the other hand, the increased political sensitivity was mentioned by one of the political actors against deepening as an argument in favour of including Zeebrugge because it would have contributed to the protection of his interests. He argued:

> *It is not very important for the outcome whether a few small villages are involved or not, or whether the tributary rivers are involved or not. Determining the outcome is whether Zeebrugge is involved. For us it might have been more interesting if Zeebrugge would have been involved. I do not expect that it would have mattered for the content, but it would have added to the tension and therefore it might have delayed the process. This was quite convenient for us because we did not need the LTV to appear quickly. For us it would have been all right if the process would have taken a few more years.*

A sound juridical base was mentioned by a commissioner as an argument in favour of the inclusion of Zeebrugge. According to the Habitat Directive, alternatives for proposed measures had to be studied. On the other hand, the policy analysts mentioned the increase in political sensitivity for including Zeebrugge as an important argument against this alternative. Also, the shift of focus from an estuary issue to a transport issue was considered an important argument by the policy analysts. Some policy analysts saw arguing against including Zeebrugge as impossible if Rotterdam weren't also included because they all have relationships with each other: if one port gets a little more business, the others get a little less because the ports are all in competition. Therefore, *justifiability* seems to have played an important role. Also, the ecologists thought it was not justifiable to include Zeebrugge because it does not belong to the ecological system. They thought that if Zeebrugge were included the entire coastal zone needed to be included. One problem was, according to the policy analysts, that the justifiability not to include Zeebrugge was also considered difficult because the relationship between the Port of Antwerp and Zeebrugge is very strong and it is therefore artificial to separate them in a study.

Despite the comments in the reports of Roos et al.(2000) and Leemhuis-Stout (2001), the economists mentioned that from an economic perspective there was no point in involving only Zeebrugge. They would have preferred to use the entire Hamburg-Le Havre range as the spatial boundaries because then the competition positions of the ports in western Europe could be taken into account. One of the economists also mentioned the lack of predictability as an argument against the inclusion of Zeebrugge:

> *About the entire range you can make some predictions, but about individual ports it is very difficult because a lot depends on the individual decisions of the shipping companies. So there is no point to involve only Zeebrugge. In the last couple of years we have seen the development that Zeebrugge is growing from a very small port with two terminals that were used very little to 500,000 TEU because a shipping company has taken over the terminals. This shipping company did not get enough space in Antwerp and does not want to wait for the building of a new dock in the Port of Antwerp. The extra costs of overland transport are largely compensated for by shorter shipping times. They want Zeebrugge because they can be in charge of an entire terminal over there. This shows that individual shipping companies have a large influence.*

According to the morphologists, Zeebrugge should have been included because near the shoreline of Zeebrugge two large barriers have a large influence on the sediment transport in the Scheldt Estuary.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 5.

4. Scheldt Estuary from Ghent to the North Sea, including the Channel from Ghent to Terneuzen

Systems analysis

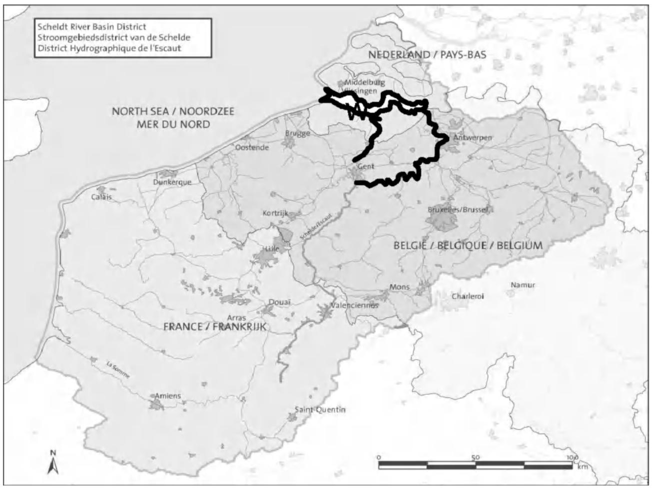


Figure 7.8: Scheldt Estuary, including the Channel from Ghent to Terneuzen (map adapted from http://www.scaldit.org)

A large part of the discharge of the Upperscheldt is diverted towards the Channel from Ghent to Terneuzen. After flowing through the Channel, a large amount of freshwater joins the brackish water near Terneuzen. The inclusion of the Channel from Ghent to Terneuzen would have been interesting because it would have provided more issue trade-offs. First, the Dutch have had an interest in the deepening of the Channel of Ghent to Terneuzen because of the presence of large industry in the Channel zone. Second, to some extent, water quality could have been involved in the system in this case. The quality of the water of the Channel has also had an influence on the ecosystem of the Western Scheldt. Therefore, cleaning the water discharge from the industry along the Channel zone might have been included as an option and used as a trade-off as well. Figure 7.8 presents a map of the selected spatial boundary and Figure 7.9 the system diagram.

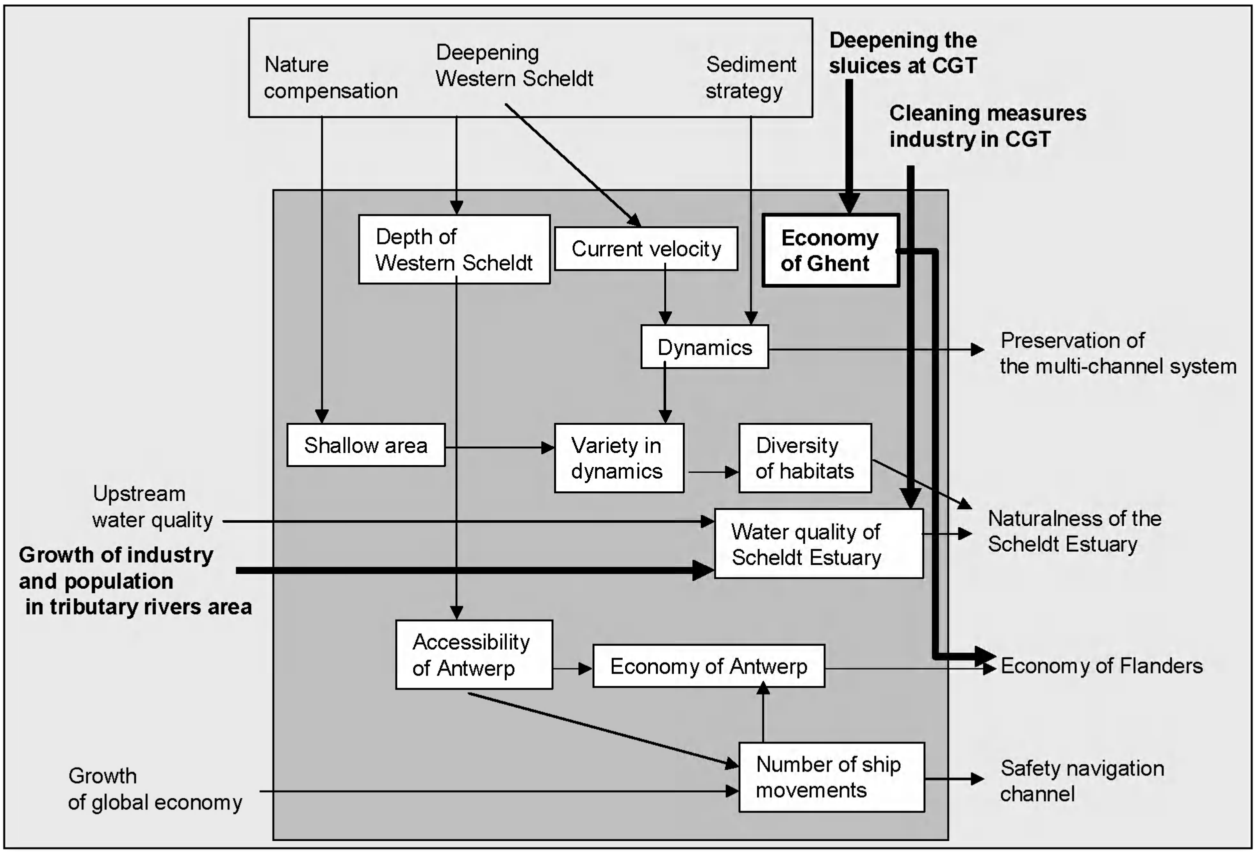


Figure 7.9: System diagram of the Scheldt Estuary including the Channel from Ghent to Terneuzen, LTV

Actor analysis

Table 7.6 shows an overview of the results of the actor analysis. Some differences exist when compared to the actor analysis diagram of the selected scale:

- AMINAL was expected to be critical at this scale because water quality would become an issue.
- The Port of Ghent would come into play as a dedicated and critical actor. The Port of Ghent would benefit from a deeper channel because it would improve the accessibility of Ghent.
- The industry along the Channel of Ghent to Terneuzen that discharges contaminated water into the Channel would come into play. This actor was expected to be dedicated and critical. The industry is a critical actor in order to improve the water quality in the area because they have to take measures to prevent pollution. The industry was expected to be dedicated as well because the option of deepening the Channel would appear on the political agenda. This option was beneficial to their interests because it would create better possibilities for shipping along the Channel.

Table 7.6: Actor analysis diagram of the Scheldt Estuary including Channel Ghent to Terneuzen, LTV

	Critical actor	**Non-critical actor**
Dedicated actor	Dutch Ministry of Transport and Water Management Ministry of the Flemish Community Port of Antwerp *AMINAL* *Port of Ghent* *Industry along the Channel of Ghent to Terneuzen*	Technical Scheldt Commission Province of Zeeland Municipalities in Zeeland Agricultural organisations Tourism organisations Nature organisations
Non-dedicated actor		-

Actor perspectives

Arguments in favour of including the Channel are that it has a large influence on the Scheldt Estuary and that the Channel is very important to the accessibility of Ghent. The presence of more issue trade-offs was mentioned by the political actor against deepening as an important argument in favour of including the Channel of Ghent to Terneuzen. This might have provided economic opportunities for issue trade-offs. A political actor against deepening explained this as follows:

> *The Channel from Ghent to Terneuzen is more strongly related to the Westerschelde than Zeebrugge, so it would be more logical to involve the Channel in the problem. The ports of Zeeland in the Westerschelde (Terneuzen, Channel zone and Sloe area) are very coherent. Other subjects could have been involved in the LTV (for example accessibility of Ghent, navigational depth of the Channel from Ghent to Terneuzen, extension of the sluices) and might have been projects in the development sketch. This might have led to advantages for us.*

He also mentioned, as an argument in favour of including the Channel, the tension that would arise between Ghent and Antwerp because Ghent would become more closely involved. The political actors in favour of deepening, on the other hand, worried about the larger emphasis on Ghent when the Channel of Ghent to Terneuzen would be included. One of them stressed that Ghent is not a container port and therefore including options that would benefit the Port of Ghent would not provide an alternative for the deepening of the Western Scheldt.

Other arguments against the deepening were two facts: the Channel is not a natural water and Ghent is not part of the river system.

For a complete overview of all the criteria mentioned in favour and against this alternative, refer to Appendix 5.

5. Western Scheldt

System analysis

In the past, the Western Scheldt (the Dutch part of the Scheldt) was often used for studying problems related to accessibility. Its boundaries fit more with the institutional boundaries because only the Dutch government needed to be involved. The Western Scheldt was therefore considered a separate alternative. The system, in this case, focused on the economic and safety aspects. Nature compensation was still mentioned as an option because it was obligatory, according to the Habitat Directive, in case of the deepening. Figure 7.10 shows a map of the Western Scheldt and Figure 7.11 the system diagram.

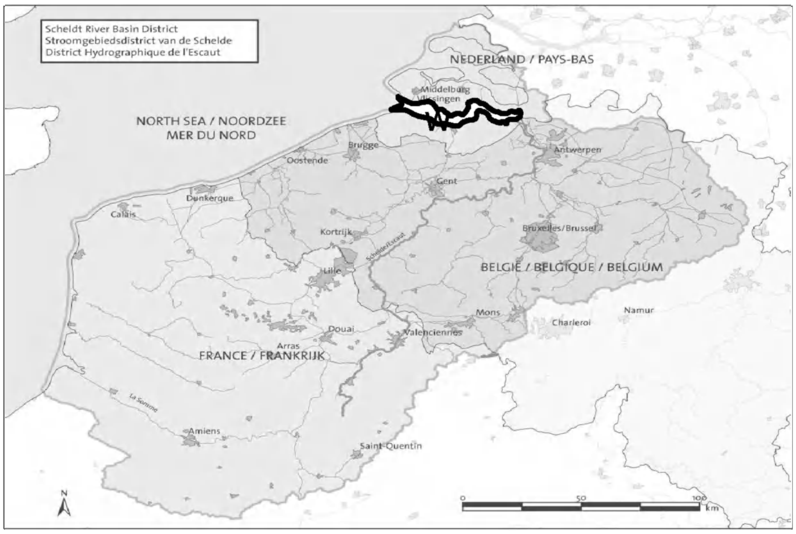


Fig. 7.10: Westerscheldt
(map adapted from http://www.scaldit.org)

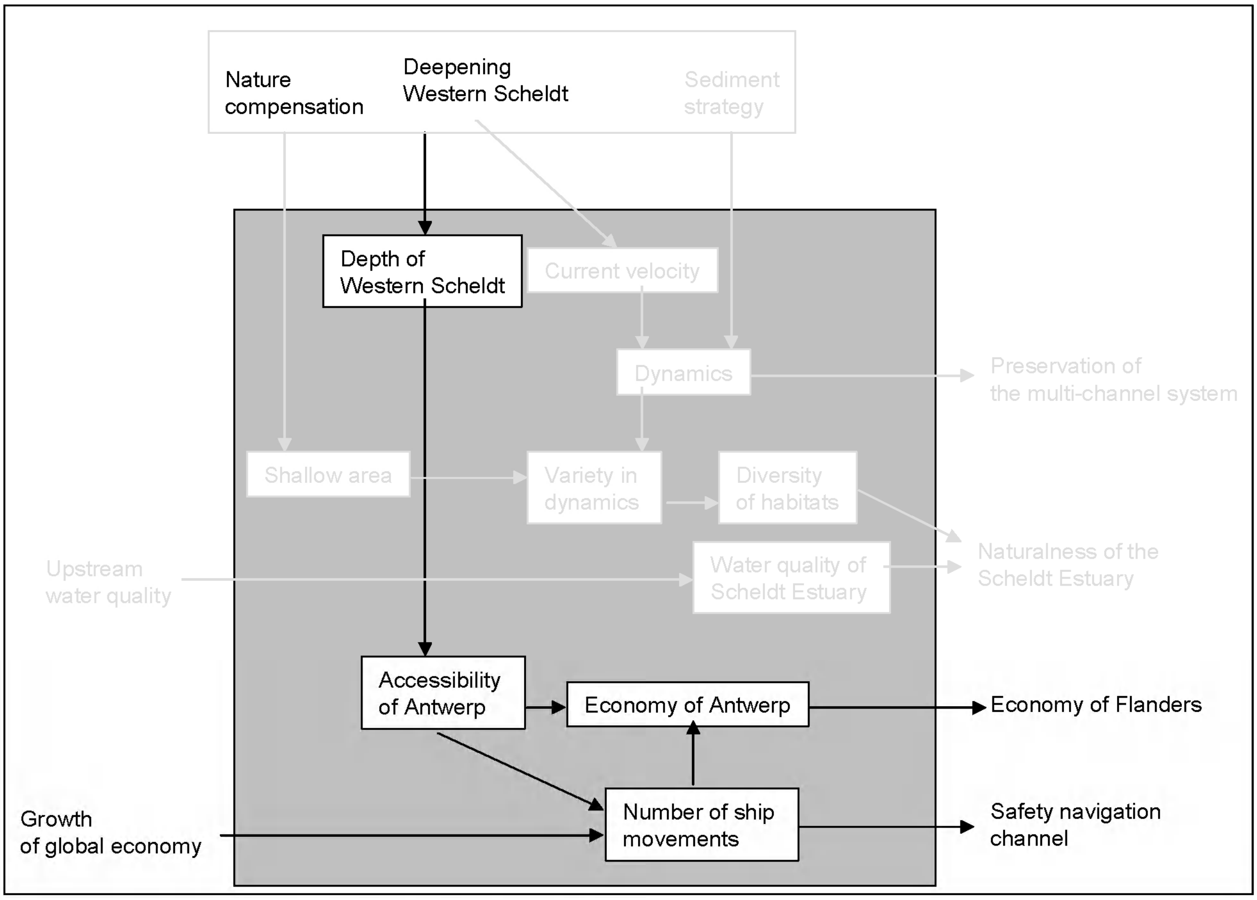


Figure 7.11: System diagram of the Western Scheldt, LTV

Actor analysis

Table 7.6 provides an overview of the results of the actor analysis. At the scale of the Western Scheldt, also the regional and local actors would become involved and would become critical. The reason for this is that nature compensation would have to be done in the area itself, which is extremely hard to realise as was learned from the earlier deepening. This issue led to enormous protests by farmers and the municipalities in Zeeland.

Table 7.6: Actor analysis diagram of the Western Scheldt, LTV

	Critical actor	**Non-critical actor**
Dedicated actor	Dutch Ministry of Transport and Water management Ministry of the Flemish Community Port of Antwerp Province of Zeeland *Municipalities in Zeeland* *Agriculture organisations*	Technical Scheldt Commission AMINAL Tourism organisations Nature organisations
Non-dedicated actor	-	-

Actor perspectives

The Western Scheldt alternative which was used in previous studies on the deepening issue seemed to be the least attractive alternative. What was bothering most actors was the fact that the balance in the project would be missing. Flanders would be the requesting party to participate in issues in the Netherlands' territory. Yet, there was nothing in it for the Netherlands (emotionally and materially). Nevertheless, it would suit the political actors in favour of the deepening fine if only the area in which the deepening was needed would be selected because it contributed to a focus on the agenda and clarity of the problem. They still felt that issues were included that were not part of the problem but realised, however, that the other actors needed to agree, which is fairly impossible when doing a study at that limited scale. The political actor in favour of deepening clearly had his interests in mind: everything that makes the project more complicated was not welcome. The lack of issue trade-offs was mentioned by the commissioners as an important argument against the Western Scheldt alternative because the flooding areas in Flanders were an important part of the solution of the deepening problem: they could be used for nature compensation. By selecting the Western Scheldt as the spatial scale, the problem became unsolvable, according to the policy analyst:

> *It is a problem that can not be solved. I want my ships to go through your territory, I give you money to arrange this. Why do you not solve my problem? This leads to endless negotiations. You can also see that in the reaction of the European Union after the first deepening phase when nature compensation measures took too much time. Less balance was present, only one measure for nature compensation was available, that caused too much resistance, namely the de-poldering in the province of Zeeland.*

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 5.

7.2.3. Summarising the major effects of the selected spatial boundaries

In this section the most important effects of the selected spatial boundaries (Scheldt Estuary without the tributary rivers) are summarised. These effects were mentioned by the actors in the interviews and observed by the researcher.

The selected spatial boundaries indeed contributed to a focus on the agenda. The spatial boundary setting contributed to the fact that the deepening of the navigation channel was placed prominently on the agenda. The focus on the agenda contributed to the fact that the study was finished on time:

- By looking at the Scheldt Estuary excluding the tributary rivers, the entire tidal area can be taken into account with a focus on shipping and the morphology of the Western Scheldt. This view limits the breadth of problems. A consequence was that other issues became less important or were not taken into account at all (for example, water quality). Because delicate issues (like water quality) were not involved on this scale, the spatial boundary setting also contributed to consensus building. The Dutch, however, succeeded in making ecology a joint issue on the agenda in addition to the deepening issue.
- The limited spatial boundaries limited the number of options. The selection of these spatial boundaries contributed to the absence of options besides the deepening and can be seen as rather solution oriented.
- The spatial boundary setting limited the number of actors involved by excluding the institutions related to the management of the tributary rivers, for example. It also contributed to keeping the actors with conflicting interests out of the scope by excluding Zeebrugge and Ghent. The limited spatial boundaries, therefore, contributed to limit the number of conflicts. The spatial boundary setting has contributed to the

prevention of conflicts because the involvement of Zeebrugge or other ports would have caused a lot more tension.

- The limited spatial boundaries contributed to the protection of interests of the Port of Antwerp. By not involving other ports in the study, also the competitive positions of the different ports were protected in a way, because none of the ports would have been willing to share confidential information on port activities which would have made the process very complicated. The limited spatial boundaries preserved the autonomy of the actors involved. This was considered a core value by the Flemish.
- The selected scale contributed to the progress and to the willingness of the actors to cooperate. A commissioner notes some positive aspects for the openness of the process compared to earlier studies that were confined to the Western Scheldt:

> *By expanding the scope compared to the previous studies, we were able to involve more actors. A lot of stakeholders that were not involved in the previous deepening could be involved now. Often, you try to limit the number of players to be able to reach a solution, in this case the opposite happened because we tried to expand the number of actors involved to be able to pay off the mortgage of the past. The only way to move forward was to take those actors seriously.*

Of course the selection of the limited spatial boundaries also had a few downsides. The flexibility in the spatial boundary setting contributed to progress during the study, but the mismatch between selected boundaries and scientific perspectives led to adjustment needs. This does not necessarily have to be a disadvantage but it led to integration difficulties for the policy analysts in the end. Although the scientific validity was not of primary importance, in a context of conflict and distrust it is always an important criterion. If a study is not scientifically valid, it is easy for actors to challenge the results if they do not agree with the outcome. The spatial boundary setting could have negatively influenced the scientific validity because the spatial scale did not match with the researchers' disciplinary perspectives. However, it did not have an influence on the scientific validity because the spatial boundary setting was adjusted by those researchers. The economists took into account the entire Hamburg-Le Havre Range, the ecologists also found a way to involve the upstream area, and the morphologists narrowed the scale and focus to the Western Scheldt because the morphological effects were considered most relevant there. By adjusting the spatial boundary setting for their studies, the researchers were able to guarantee the scientific validity of the study.

Another downside was that the province of Zeeland had the feeling that they did not have anything to gain in the process because of the lack of issue trade-offs that were of interest to them. The absence of trade-off possibilities gave the province of Zeeland the feeling that the benefits of the deepening were unequally distributed: they felt that they suffered from the disadvantages while the profits were mainly present elsewhere. A political actor against the deepening stated:

> *There is no balanced package that you can explain to people. Inhabitants of Zeeland have the feeling that deepening projects will continue to take place, nature compensation projects are executed on the territory of Zeeland and the people in Zeeland do not benefit from it. There are disadvantages but no advantages. Therefore, we will delay the deepening as long as possible by using legal procedures, anyway as long as there is no balance in the different interests. When issue trade-offs exist, an agreement will be reached. There is no political space to agree with the deepening but the deepening will proceed anyhow. The question is then, how can we handle it in such a way that we benefit from it as well?*

Figure 7.12 summarises the effects of the spatial boundary setting in a causal diagram. Again, it is emphasised that the relations are tentative and plausible.

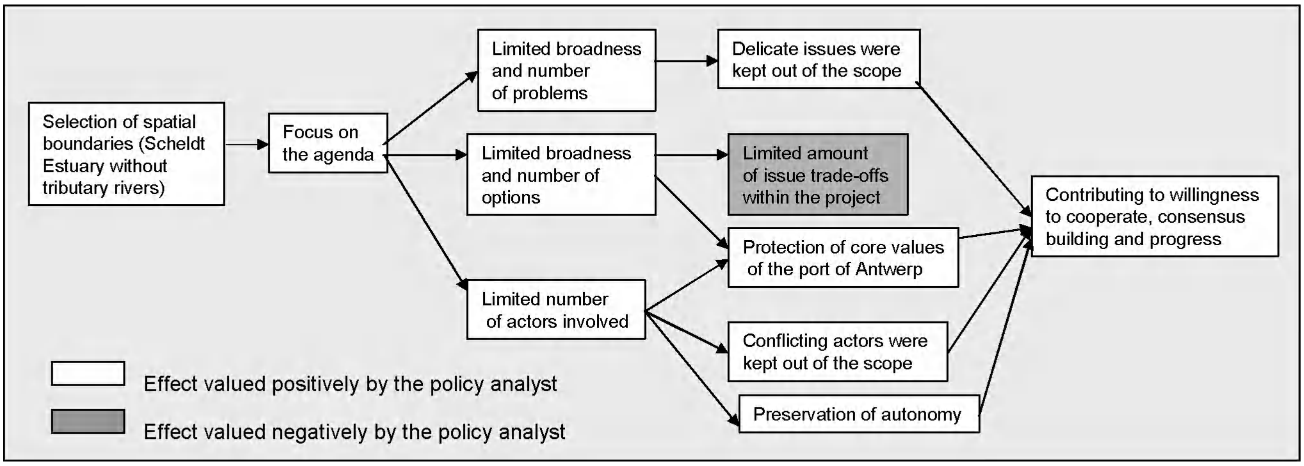


Figure 7.12: Causal diagram of observed effects of the spatial boundary setting in the LTV

7.2.4. Concluding remarks

Contribution of the spatial boundaries to the achievement of study's objectives

The spatial boundary setting did contribute to the success of the study. Although the selected spatial scale contributed to placing the deepening issue central on the agenda, it is important to realise that no matter what spatial boundaries would have been selected the deepening would have been a key issue because of its controversy.

The spatial boundary setting contributed to the consensus building because delicate issues (like water quality) were not involved at this scale and actors with conflicting interests (like Zeebrugge) were not involved either. Although no issue trade-offs were present within the project boundaries, this did not withhold actors from finding issue trade-offs outside the project (e.g. the High Speed railway). The effects of scale choices on the possibilities of issue trade-offs were therefore considered to be of minor importance in the LTV.

The spatial boundary setting did, however, contribute less to the *design and recommend* goal of the study. The selected scale contributed to the action ability, but not to the breadth of options, which is also considered important in "design and recommend". The only options taken into account on an abstract level were to deepen or not to deepen. Compared with the number of options that would be present when using alternative spatial boundaries, this is rather limited.

Effects of the spatial boundary setting

The actors mention a great number of arguments that played a role in the process of spatial boundary setting. More than a hundred arguments were mentioned. The arguments also had considerable variety: more than forty different effects were mentioned. The effects are presented in Table 7.7. This table shows that the spatial boundary setting in the LTV had effects related to all rationalities.

Table 7.7: Overview of the types of effects of spatial boundary setting mentioned and observed in the LTV

Effect	Clustered effect	Related rationality
Scientific validity Complexity Inclusion of available knowledge Quality of the study Systems completeness Legal validity	Validity of the study	Scientific
Clarity of the problem Inclusion of issues Inclusion of options	Content of the study (type and depth of problems addressed, options identified and impact assessed)	
Willingness to cooperate	Commitment	Political
Autonomy of nations Protection of interests	Protection of interests	
Possibilities for issue linkage Common interest of actors involved Possibilities for consensus building Political sensitivity	Possibilities for consensus building	
Balance between actors involved Inclusion of important actors	Openness	
Number of issues Number of options Broadness of problems Broadness of options Coherence of issues Coherence in options Comprehensiveness	Broadness and coherence of analysis, options and effects	Design
Quality of decision making Relevance (for actors involved/ for decision making) Economic relevance	Policy relevance	
Decision-making ability Action ability Solvability of the problem	Action ability and usability	
Justifiability Disputability of the study Clarity of boundaries and boundary conditions	Justifiability	
Governmental coherence (one initiator) Match with level of authority of commissioner of the study	Legitimacy of the commissioner	
Progress Number of actors, issues, languages and nations involved	Progress	Managerial
Focus on the agenda	Focus on the agenda	
Coordination burden Practical workability Feasibility	Manageability	
Efficiency Time needed for the study	Efficiency	

Although many arguments had a relation to the effects of the scale choices, some of the arguments were related to boundary conditions that were present at the start of the policy analysis process or contextual conditions in which the scale choices had to fit at the end of the study:

- Fit with other (legal) frameworks
- Interference from other plans
- Overlap with other arenas/ treaties
- Possibilities to line up with other plans
- Uniformity/ synchronism of policy

Similarities and differences in actor perspectives
All archetypical actors mentioned the effects of coherence of issues, complexity, justifiability, number of (scientific) actors involved, relevance and system completeness (see also Table 7.7). Because all actors mentioned these criteria, they are considered to have played an important role in the spatial boundary setting in the LTV. Criteria that are mentioned by all actor archetypes except the researchers are the number of actors involved, the number of nations involved, the overlap with other treaties and arenas, and the fit with other legal frameworks.

Similar effects are mentioned by different actors but are sometimes valued differently. An example is the inclusion of water quality in the Scheldt River Basin alternative. A political actor against deepening and a commissioner regarded it to be an argument in favour that water quality can be taken into account. A neutral political actor addressed it as an argument against because it was such a delicate issue that could not easily be solved. Amongst the policy analysts different opinions existed. One policy analyst called it an argument in favour that pollution issues can be included, while another one called the involvement of water quality an argument against because it was a parameter that was difficult to influence and not related to a lot of important aspects of the study (accessibility, safety and morphology).

Although it is logical that effects are valued differently by different actor archetypes, differences also existed in their opinions about the nature of effects. Some interesting examples are:

- Discussion seemed to be present between the actors about whether the Channel from Ghent to Terneuzen was part of the ecological system or not. Two political actors mentioned the fact that the Channel was not a natural water as an argument against this alternative. A policy analyst called the Channel 'not really a part of the river system'. The ecologist, however, thought that from a systems point of view it was important to take the Channel into account because it has an important influence on the river system.
- In the discussion of the *Scheldt Estuary including the tributary rivers* alternative, different opinions existed about whether or not more actors would be involved. An argument that was taken up in the report was that the regional water systems were not included because the number of governments had to be limited. One of the policy analysts also mentioned the fact that more governments would need to be involved as an argument against this alternative. A political actor added, as an argument against this alternative, that small municipalities at the table would lead not only to a delay of the study, but he expected that also the level of professionalism would be lower. Another political actor did not agree with the statement that more actors would become involved because, according to him, the tributary rivers also fell under the jurisdiction of Flanders and were not delegated to the provinces. So, no more regional governments would need to be involved if the tributary rivers were involved. It seems that on this point no consensus existed about the effects of this alternative.

The conclusion that can be drawn from the above is that an assessment of the effects of scale choices is not that simple. If these differences of insight occurred during a study, it might affect the actors' preferences. Therefore, it is important to get some clarity on the effects by discussing them amongst the actors involved because otherwise misunderstandings and even conflicts could arise.

7.3. Water Shortage Study

7.3.1. Analysis of the selected spatial boundaries

National scale

As presented in Chapter 6, the selected spatial boundary of the study was defined as the Netherlands (i.e. national scale). Figure 7.13 presents a map of the selected spatial scale.

Figure 7.13: National scale: The Netherlands

Systems analysis

To be able to construct a system diagram, it is important to understand the significant processes and variables that play a role. The two basic processes lying beneath the water shortage problem are the processes of water supply and of water demand. The water supply depends mainly on the water discharge from the rivers at the Dutch border and the rainfall in the Netherlands. The water demand is determined by developments in the national economy and the population. At the national scale, important questions are how to distribute the water among functions which play a role at the national scale (e.g. electricity production and shipping), and how to distribute the water among the regions within the nation. On a national scale, only a few options are available: the water can be distributed differently across the regions by adjusting the water distribution near Driel, water intensive crops can be moved to a part of the country where more water is available, or large scale adjustments to the infrastructure can be made, like building a new channel between the rivers. Water quality is also influenced by water shortage. Often, water shortage occurs in very dry, warm periods, so the temperature of the water is also high. This may cause algae to grow and reduce the amount of oxygen in the water. Electricity production is damaged by this because the electricity plants are not allowed to discharge water when it is above a temperature of 30 ° C. This is rather difficult when the river water they let in the plant as cooling water is already quite hot. In Figure 7.14, these processes are illustrated in a system diagram.

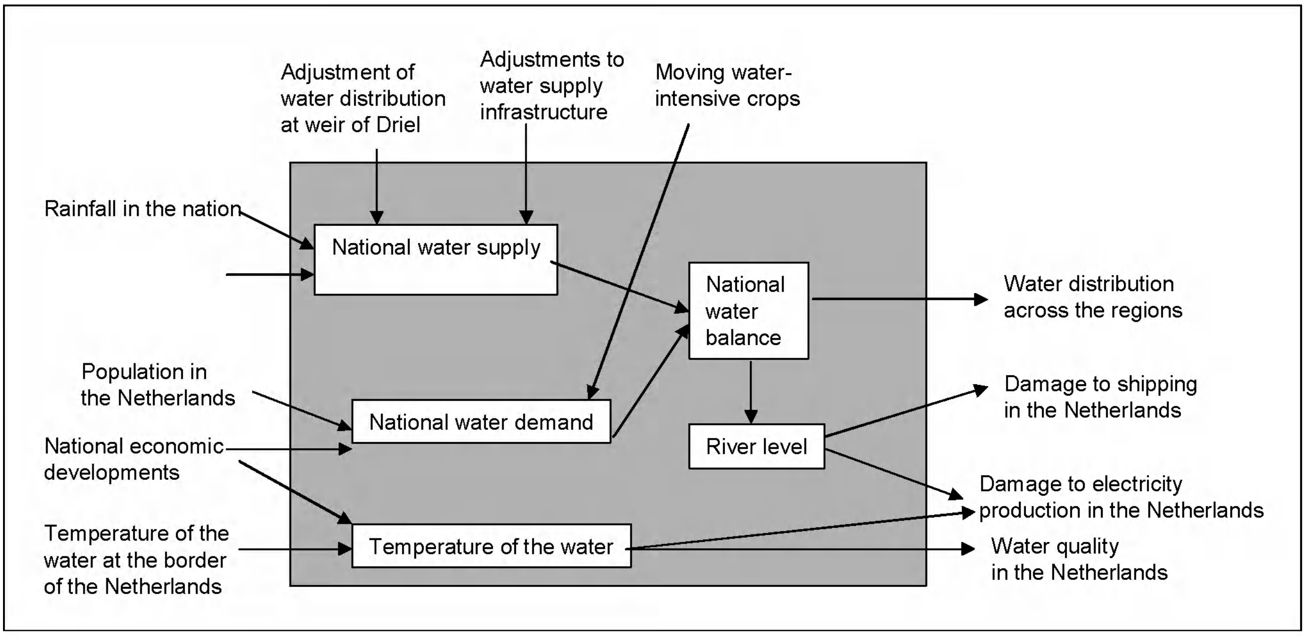


Figure 7.14: System diagram of the national scale, WSS

Actor analysis

The only actors involved that were absolutely dedicated to the water shortage issue on the national scale and critical were the Ministry of Transport and Water Management and their research institute, RIZA. The researchers of RIZA were very interested in the study because it also provided an opportunity to make an update of their models. Other critical actors were the water boards, but most of them were not very dedicated at the start of the study because they were not convinced of the size the problem and the consequences, and they considered the national approach less useful. Some water boards, however, felt dedicated to the water shortage problem. Water boards in the western part of the Netherlands, for example, were concerned about salinity problems during the dry periods. RIZA felt dedicated to the problem but was not critical because it is a supporting institute of the Ministry. The Ministry of Nature and Agriculture felt dedicated to the problem because of the effects on agriculture and nature but were not critical because they have few instruments to solve the problem. EnergieNed felt dedicated to the problem because in past years some problems with the temperature of the water discharge occurred but was not critical to solve the problem. IPO did not feel dedicated to the problem of incidental drought because they did not expect big problems because of it. They felt, however, dedicated to the problem of structural drought (nature) in the long term. The VNG stated that the problems were too far from their interest. The LTO was not convinced of the urgency of the problem and therefore felt less dedicated. VEWIN, VNG and IPO have some means to influence the water shortage situation, but these means are rather limited. Therefore, these actors were not regarded as critical (Buijsrogge, 2001). Table 7.8 gives an overview of the results of the actor analysis on the national scale.

Table 7.8: Actor analysis diagram of the national scale (at the start of the study), WSS

	Critical actor	Non-critical actor
Dedicated actor	Ministry of Transport and Water Management Some water boards in the western part of the Netherlands	RIZA Ministry of Nature and Agriculture EnergieNed Shipping trade in the Netherlands
Non-dedicated actor	Most water boards	IPO VNG LTO VEWIN

Actor perspectives
The commissioners agreed that an action orientation is best at a national scale because at that scale large switches divide the water. The initial question is whether it is necessary to change the national distribution. This question needs to be answered first. Only in the main rivers is there water that can be divided differently across the country. In the smaller areas only fine-tuning options are available. They thought the analysis on the national scale contributed to an understanding of the interdependencies between the regions. Also, the national scale matched best with the commissioners' level of authority.
An important criterion for the analysts also seemed to be the available data and models. A lot of models were present on the national scale. According to the analysts, the selection of the Netherlands as a spatial scale largely corresponded with the partial river basin approach because the river basin of the Rhine comprises the largest part of the Netherlands. The national political actors thought it was important to take the electricity production into account because frequently in past years, the discharge of warm water by electricity plants had to be tolerated. Also, they considered the national scale to be a logical choice because WB21 was the starting point and also a national program. An economist thought it was important to start on a national scale. Then, uniformity would be created and it would be possible to make the regional studies comparable. Also, it is good to first compare options at a national scale. He explained:

> *You can see what kinds of measures can be taken in regions to compensate for losses in other regions. For example, you can choose failure of a certain crop in a certain area if that provides another area with sufficient water to make that crop succeed. It is a matter of overall economic optimisation in that case.*

The political actors all mentioned the limited dedication of the regional actors as an argument against the national scale.

For a complete overview of all the criteria mentioned in favour of and against the selected spatial boundaries, refer to Appendix 5.

7.3.2. Thought experiment

Besides the selected alternative (i.e. the national scale), two alternatives that played an important role in the spatial boundary setting are discussed, as displayed in Table 7.9. The concept of the thought experiment was explained in section 4.5.2.

Table 7.9: Alternatives studied in the WSS spatial scale thought experiment

Larger spatial scale	Smaller spatial scale
River basin scale	Regional scale

The river basin scale was stressed by representatives of regional directorates of Rijkswaterstaat that were situated close to the borders of Germany and Belgium. The regional scale was described as important by all actors involved.

River basin scale

System analysis

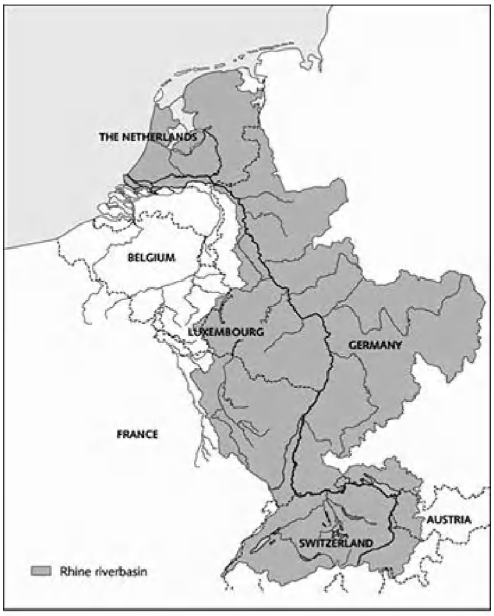


Figure 1. The river basin of the Rhine.

Figure 7.15: Example of a river basin, river basin of the Rhine (Source: webworld.unesco.org

At the river basin scale, the same processes of water supply and demand play a role as at the national scale but covers the river basin. At the *river basin scale*, the main question is how to distribute (as far as possible) overall shortage among nations upstream and downstream. Because the Netherlands is situated in a deltaic area, it is dependent on Germany (upstream) for sufficient water discharge along the Rhine, and on Belgium for sufficient water discharge along the Meuse and the Scheldt. With Belgium, agreements have been reached on the minimal discharge along the Meuse, called the Meuse Discharge Agreement (Internationale Commissie voor de Bescherming van de Maas, 2001). For the Rhine River ,this is not yet the case. The largest part of the Netherlands belongs to the Rhine River basin. Therefore, this river basin is taken as the starting point. All variables that were defined for the nation are redefined for the river basin. Also, options need to be redefined for the basin. This results in new options (like agreements on minimum water discharge), similar options that are available in the entire river basin (moving water-intensive crops, adjustments to water supply infrastructure) and options that fade into the background because they are more nationally oriented (like adjustment of water distribution at the Driel weir). Some exogenous factors are not input variables anymore (like water discharge at the border of the Netherlands and temperature of the water at the border of the Netherlands), because they are now part of the system. The outcome variables stay more or less intact because these issues are also important in an international context. Figure 7.15 presents a map of the Rhine River Basin which was selected as an example of the river basins in the Netherlands because it covers the largest part of the Netherlands. Figure 7.16 shows a system diagram of the river basin area.

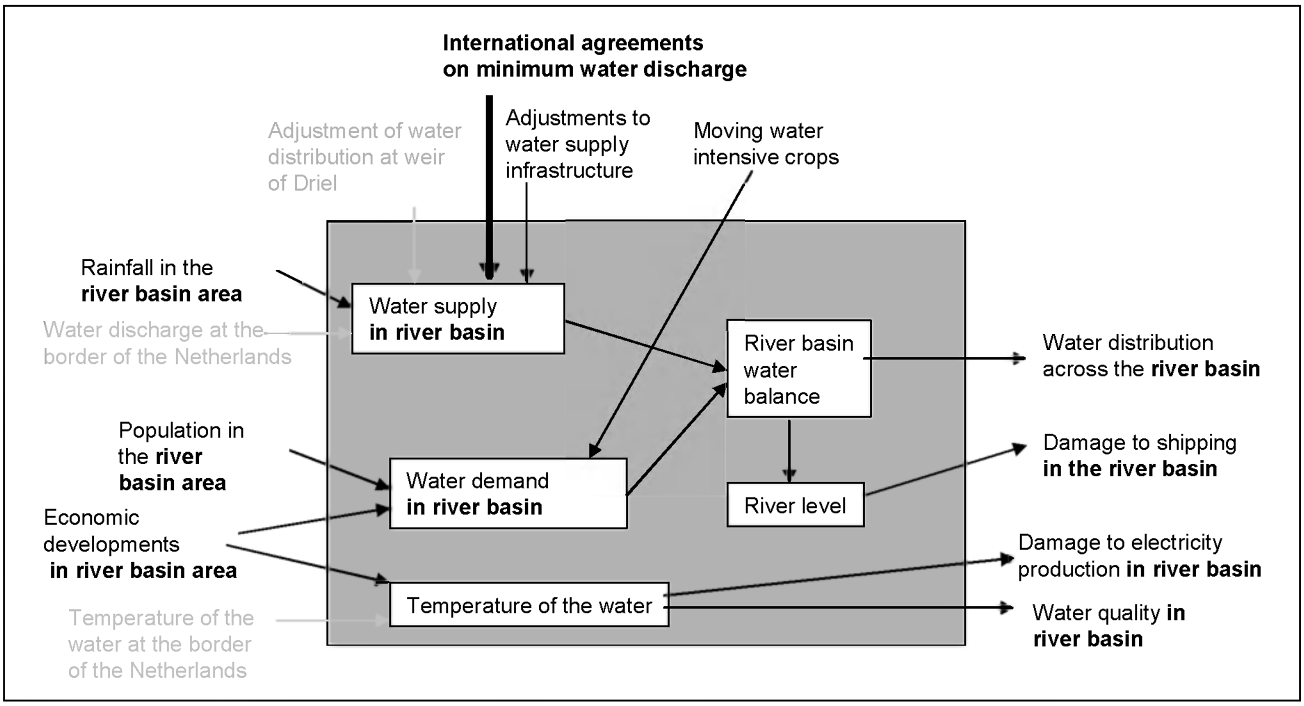


Figure 7.16: System diagram of the river basin, WSS

Actor analysis

Table 7.10 shows an overview of the results of the actor analysis on the river basin scale. Some differences exist compared to the actor analysis diagram of the selected scale:

- Actors that came into play were the ministries concerned with water management in Germany and Switzerland (for the river basin of the Rhine) and the ministries in France and Belgium (for the river basin of the Meuse and the Scheldt). The ministry in Switzerland was expected to be critical but less dedicated to the problem of water shortage because Switzerland is not faced with many water shortage problems as it is situated upstream. The ministries in Germany, Belgium and France were expected to be critical and dedicated because they are also faced with water shortage issues.
- The water boards were considered to be less critical at this scale, because options are discussed at a much larger scale.
- Cooling water became an important issue. Therefore, electricity plants that use cooling water in Germany and the Netherlands got involved as a dedicated actor because they are also faced with the problems caused by the high water temperature.
- Shipping on the entire river

Table 7.10: Actor analysis diagram of the river basin, WSS

	Critical actor	**Non-critical actor**
Dedicated actor	Ministry of Transport and Water Management *Ministries concerned with water management in Germany, Belgium and France*	RIZA Ministry of Nature and Agriculture EnergieNed Shipping trade *on the river Rhine* *Electricity plants in Germany and the Netherlands*
Non-dedicated actor	*Ministry concerned with water management in Switzerland*	IPO VNG LTO VEWIN *Water boards*

Actor perspectives

Some actors would have liked to scale up the analysis to the river basin, but most actors mainly saw disadvantages of this alternative such as the complexity, political sensitivity, increasing dependency from upstream and the involvement of more actors. Also, it was questioned what the need would be and what would be gained from it. It was not considered realistic to expect more water at the state boundary, so the problems needed to be solved by the Dutch alone. Some regional political actors (especially the ones near the national boundaries) were bothered by the fact that in water flooding problems the river basin approach was followed more closely than in the Water Shortage Study. A regional political actor wondered:

> *I do not understand why, in water flooding studies, upstream countries tend to get involved and in the Water Shortage Study they don't. I see as many reasons to involve the upstream countries in the water shortage problem as well.*

According to the national political actors and the commissioners, the choice of a spatial scale also depends on which part of the problem is considered. Some issues that are related to water shortage, like cooling water, are better studied at a river basin scale because of its international character. It should be discussed as a joint issue, for example as part of the European Framework Directive-Water. It should not therefore be included as an issue under the Dutch Water Shortage Study. A commissioner of the study responded:

> *If we take into account the temperature as a quality element, I think it is important to include the upstream countries. The Rhine when entering at Lobith sometimes has a temperature of 23° Celsius. In 2003 the temperature was even 28° Celsius. This means that the electricity production at Nijmegen had to be reduced largely. You could say that the Germans are shifting their problem towards us. This issue has been addressed in the Rhine commission. A cooling water commission was established. This was however terminated in 1989. At the moment we are making attempts to get this issue back on the agenda. It is a very politically sensitive issue.*

According to the commissioners, arguments not to select the river basin scale were the limited possibilities to schedule discussing the problem, the decrease in focus on the agenda, and the limited action orientation. Opportunities to discuss the problem are thought to be related to the urgency of the issue and its relation to other issues. In order to deal with the problem internationally, it is important that every nation experience similar problems. If not, other issues will get on the agenda, leading to a different focus. A commissioner of the study gave an example:

In France people are dying because of the heat. Also, some areas cannot be provided with water at all. They are more concerned by those kinds of problems than water shortage in the Meuse River Basin. At the river basin scale it is therefore possible that other issues get on the agenda that might be less interesting for us. The focus might be entirely different or entirely missing.

Another commissioner also thought that it was easy to say that the problems had to be resolved upstream. Another important issue in getting the problem on the agenda was the feeling that it was good to have better insight into the problems at the national scale first, because then it would be possible to start asking the right questions on the river basin scale. Also, the action orientation was thought to decrease because long processes are needed to come to an international agreement. A policy analyst agreed and explained:

The river basin scale makes it just too complicated to handle. If you want to do something on a river basin scale the process will be difficult and long long term. It is extremely difficult to make agreements on an increase of water discharge at the borders of our country. In the past an initiative was organised to discuss the water shortage situation on an international scale, with Belgium and France about the discharge on the Meuse, but if it is an initiative of the Netherlands and it is pushed too hard you see a lot of resistance in the upstream countries. Therefore, it was also thought to be difficult to involve people from upstream countries in the WSS.

An economist thought that at least a quick scan of the river basin needed to be made to explore the options upstream. Also, the international agreements on water had to be studied.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 5.

Regional scale

Systems analysis

Figure 7.17: Example of regions

At the regional scale, the same processes of water supply and demand play a role as at the national scale but are confined to the region. At regional and local scales, the direct impact for the stakeholders that depend on the regional water system become visible and additional trade-offs have to be made regarding priorities in distribution. The regions depend on the national water system for their water. Agriculture depends on the regional system for water for irrigation purposes. A lot of drinking water companies extract groundwater to provide their customers with drinking water. Terrestrial nature also depends on the groundwater. So, groundwater starts playing an important role on a regional scale. At this scale national water distribution becomes an exogenous factor instead of an option to change. Other exogenous factors that come into the picture are the seepage that is a local factor of influence and the possibility for water supply. Some regions have less water supply possibilities than others because the water from the main water system just does not reach the region because of the lack of channels. The construction of additional channels might provide an additional option so *adjustments in water supply infrastructure* remained an option. The option "move water-intensive crops" was replaced by "grow fewer water-intensive crops", because movement to another part of the Netherlands was not under the authority of a region. An additional local option was added: the creation of water storage basins to store water that can be used in times of water shortage. Figure 7.17 shows a map containing an example of a division of the Netherlands in regions and Figure 7.18 shows the system diagram.

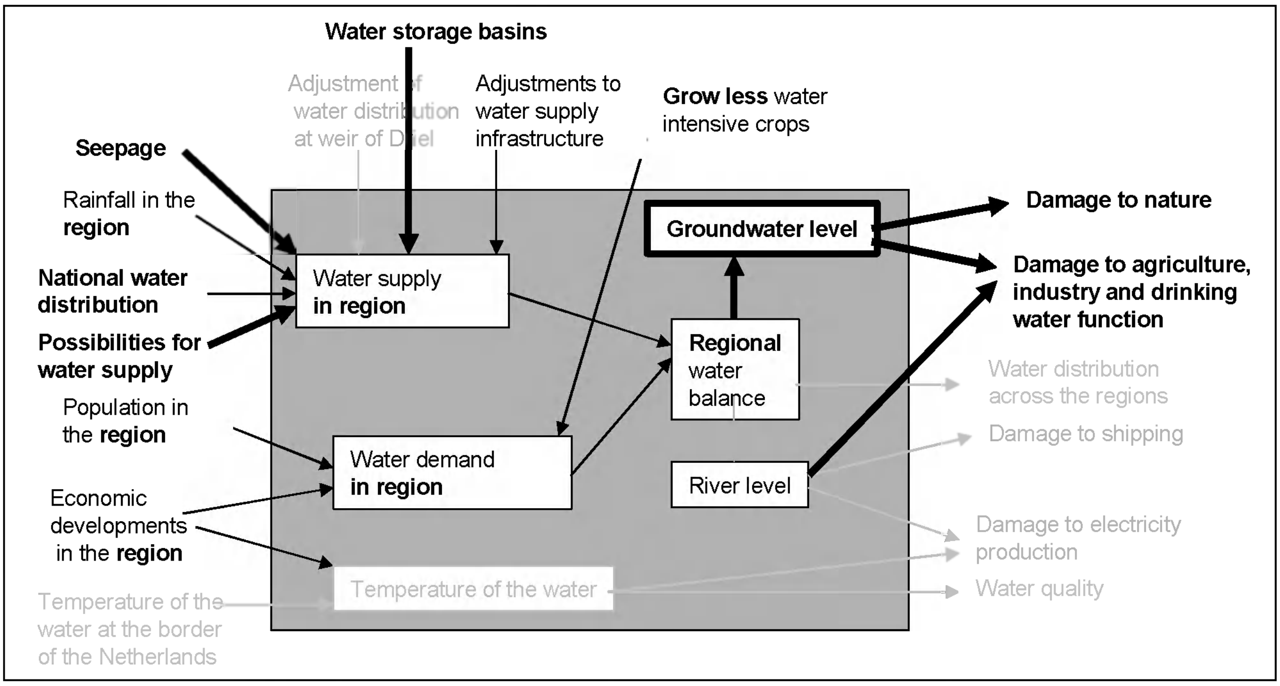


Figure 7.18: System diagram of the regional scale, WSS

Actor analysis

It was rather difficult to construct the actor analysis diagram for the regional scale. The reason for this was that Buijsrogge's (2001) actor analysis showed that a lot of actors not only feltl not dedicated to the problem of water shortage on the national scale but that they also did not consider the problem of water shortage to be very urgent at all. So, the perceived urgency of the problem came into play and, in addition to the scale, determined their level of dedication. Therefore, a question mark is added to some actors to note that their dedication is not clear.

The actor analysis diagram was expected to show an entirely different picture than the actor analysis diagram of the selected national scale; the roles seemed to have turned around. Table 7.11 provides an overview of the results of the actor analysis diagram on the regional scale. Considering the regional scale, the following results were expected:

- The water boards that considered water shortage to be a problem would become the only critical and dedicated actors.
- The Ministry of Transport and Water Management and RIZA would be non-dedicated actors at this scale because they would only have authority over national waters. Therefore, the Ministry of Transport and Water Management was also considered non-critical on this scale.

- EnergieNed and the shipping trade would be non-dedicated actors at this scale, also because of their interest in the national waters.
- IPO, VNG, LTO, VEWIN were all expected to move from non-dedicated to dedicated.
- The Ministry ???
- The municipalities and provinces would enter the diagram as dedicated but non-critical actors.

Table 7.11: Actor analysis diagram of the regional scale, WSS

	Critical actor	**Non-critical actor**
Dedicated actor	Some water boards in the western part of the Netherlands Most water boards?	*IPO?* *VNG?* *LTO?* *VEWIN?* *Municipalities?* *Provinces?*
Non-dedicated actor	-	*Ministry of Transport and Water Management* *RIZA* *Ministry of Nature and Agriculture* *EnergieNed* *Shipping trade*

Actor perspectives

All actors agreed that, although some positive aspects are related to this alternative like more options, more fine-tuning possibilities and better insight into the system, the disadvantages outnumbered the advantages. The commissioners thought that the sense of urgency felt by the regions was not large enough to start regional studies. The reason is that water shortage calamities are scarce. According to a commissioner, this was confirmed in another context:

> *When the visions for the partial river basins were developed we asked the actors involved to evaluate the water shortage problem. Ninety-five percent of the commissions working on the visions reported that they could not say anything about water shortage. That makes me believe that they do not have a large problem with water shortage, otherwise they would have been able to say something about it.*

A regional political actor agreed that the water shortage was not felt to be an urgent problem by the regions:

> *At the moment the study started water shortage did not have a priority in the regions because everybody was very busy with the water flooding problem. So, regional studies on water shortage were not very likely to start at that time. If the national study shows that some regions have a problem, then it will get more priority and the municipalities will become involved.*

Both commissioners agreed that studies on a regional scale would not have very useful results because of the risk of a shift of the problem to the national scale or to another region. A commissioner explained:

> *There is a risk that you get a story that tries to put the problems specific for that region on the agenda: we have these kinds of problems and we need this amount of water. If all regions are asked for a regional study and react like that, you do not get a result that is overall useful. We have to make sure that recognition exists in the regions that it is their task to solve the problem. By doing a national study first, it becomes clear to them that they cannot shift the problem to a higher scale. Another problem is that regions start to point at each other to put*

> *the blame somewhere else. Especially for the downstream regions, it is easy to say that solutions have to be found in the upstream regions. We want to prevent that.*

A policy analyst agreed, but also put the importance of the national scale into perspective:

> *If you organise the studies on a regional scale, you miss the national framework. The regions should have to come up with solutions and the national scale should provide an extra criterion: for example, does the policy option have no negative effects on the other regions?*

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 5.

7.3.3. Summarising the major effects of the selected spatial boundaries

Because of the selection of the national scale, the main focus was the main water system. This made it possible to study the efficiency of the current national water distribution system. This increased the relevance of the study because water distribution is a very fundamental issue that influences the entire water supply in the Netherlands. If there is no clarity on that matter, it is difficult to start talking about other options.
Important factors like precipitation in the Netherlands could also be taken into account. Therefore, not only the discharge of the rivers played a role, but also climatological factors could be involved. Because the Dutch water system is very much man-made, the selected spatial boundaries did not conflict with the boundaries of the hydrological system.
On a national scale, one of the few policy options present was to determine the distribution of water on the IJssel and the Rhine through the sluice in Driel (respond-category). Other options were to relocate the water-consuming crops and trees (prevent-category) and adjust the water infrastructure by building additional sluices and canals, but these were considered too radical considering the size of the problem and the outcome of earlier studies (PAWN). Other policy options were mainly present at the regional scale but the initiators of the study did not have authority to start looking at options on a regional scale. The action ability after the study was limited. The reason for this was that few measures at the national scale were present. Most policy options were available at a regional scale, therefore regional studies had to be started.

It seems very logical that focusing on the main system and the limited set of national options led to an initial low commitment of the regional actors. From the actor analysis performed by Buijsrogge (2001), it could be concluded that the VNG (the umbrella organisation of municipalities in the Netherlands) was not dedicated to a study on a national scale. They recognised that low groundwater levels can have a large effect on piling foundations. However, they did not feel dedicated to a study on a national scale; problems on a national scale did not appeal to them. Also, they did not regard water shortage as an urgent problem. However, a lot of solutions for the water shortage problem have to be implemented on a regional level. If they are not involved in the study in the first place, they might not feel committed to the solutions that are suggested in the national study. Not getting involved might also be a strategic choice for later: not agreeing with the findings of the study. IPO (the organisation of the provinces) did not feel dedicated to the problem of incidental drought because they did not expect big problems. They felt dedicated, however, to the problem of structural drought (nature) in the long term (Buijsrogge, 2001).
Some regional actors did not initially feel dedicated to a study on a national scale because a study at this scale would be less interesting for them. The results, though, might affect some of the regions considerably. One of the few policy options available on a national scale was to

adjust the national water distribution. This caused a 'wait and see' attitude towards water shortage with many regional actors. An adjustment of the water distribution could have a huge impact for several regions. By doing this, one region would be privileged over another, so this might cause a lot of resistance in the regions that would receive less water than in the present situation. It could, therefore, be expected that although many regional actors did not get involved at first, they would closely watch how the study would evolve.
A study by Bekebrede (2001) confirmed this lack of interest for a national scale study by regional actors. In interviews she conducted, it appeared that regional actors in the area of the Dommel River were hardly interested in the national Water Shortage Study. They considered dependency on the main water system to be so limited that the measures taken on a national level would have no influence on their region. Of course, not all regions are independent of the national scale. The regions in the western part of the country and the regions in which the water supply is difficult because of the lack of open waters are expected to be influenced a lot by national measures.

The non-dedicatedness of the regional actors, such as the municipalities, the provinces and the water boards, to a study on the national scale did not cause a delay in the process; they just did not get involved in the study at first.

One of the national political actors reacted:

> *It follows as a matter of course that the regional actors have a waiting attitude. There is not much you can do about that. I doubt whether the regions would have done anything on their own, though. The water board of Rijnland was one of the few water boards involved in studies about water shortage before the Water Shortage Study of the Netherlands started. That can easily be explained: they have fresh water but are surrounded be saltwater. Water shortage is not their real problem but sufficient fresh water is. The other regions do not really have such a big problem and are therefore also not so eager to know what the results are.*

One of the regional political actors stated:

> *I think the fact that the Water Shortage Study was executed was an argument for many regions not to start a research study on their own. I have waited for a water board to stand up and say: we want more water. But this did not happen. Nobody took the initiative. This shows that there is a lot of understanding for how things are. Also it is an example of the hierarchical nature of the water world. You also could conclude that the problems in the region are not that big or urgent.*

Because it was recognised that the involvement of regional actors was important and that the regional actors were less dedicated to a study on a national scale, a lot was done during the study to involve the regional actors, such as naming the workshops Water Shortage Days, holding round table discussions in the regions, stimulating the regions to start studies on a regional scale, and involving three members rom the regions in the project group. The regional actors became more dedicated during the progress of the study. Also, the water shortage situation of 2003 might have contributed to the added dedication of the regional actors.

One of the policy analysts reacted this way:

> *On the one hand, the regions appeared to be glad for a national study; it was for them also something they could stand behind. On the other hand, it was clear that the regions felt the national study to be a threat for them. Initially, in the regional round table discussions, there was a lot of resistance by the regions. The feeling seemed to exist that they wanted to solve*

their own problems and did not want the national government to interfere. One region commented that they did not have a water shortage problem and thought that the people in the ivory tower did not seem to get the problem.

Because the Netherlands was selected as the spatial scale, use could be made of existing precipitation data. For the river basins, precipitation data were not readily available. Also, use could be made of available national models.

Figure 7.19 summarises the effects of the spatial boundary setting in a causal diagram. Again, it is emphasised that the relationships are tentative and plausible.

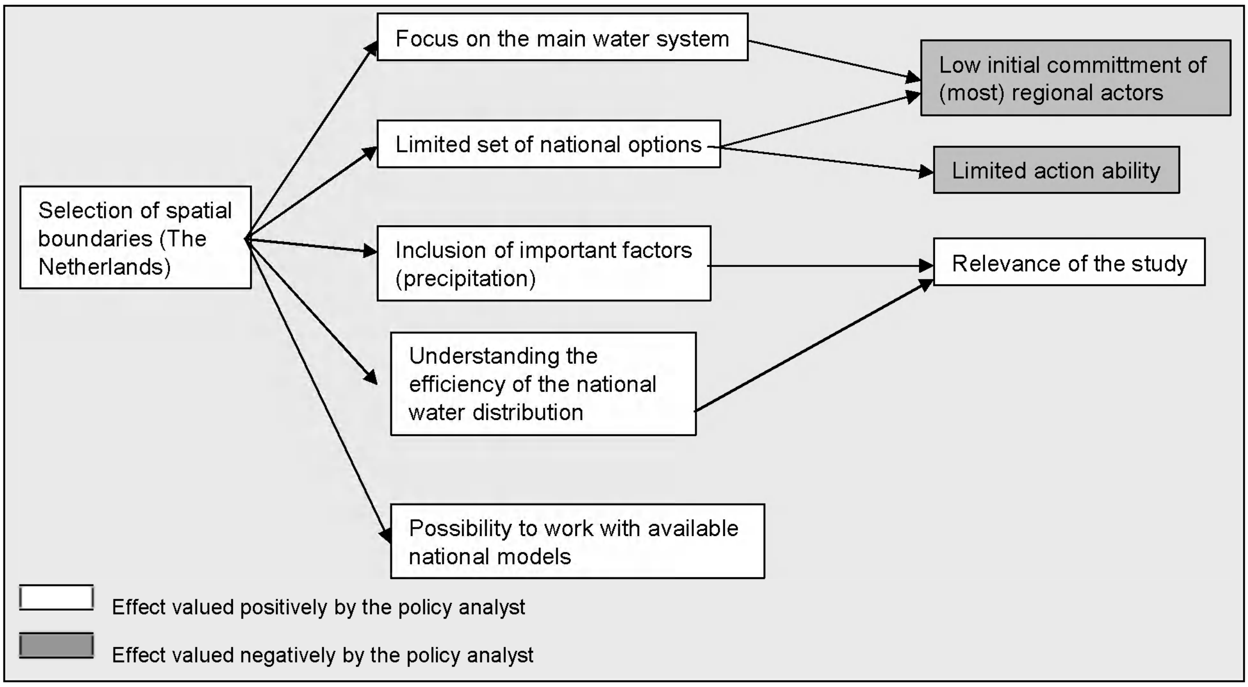


Figure 7.19: Causal diagram effects of spatial boundary setting in the WSS

7.3.4. Concluding remarks

Contribution of the spatial boundaries to the achievement of study objectives
The spatial boundaries contributed to the *research and analyse* objective because meteorological droughts could be included. In the beginning it was thought that the action ability was good because some options with big effects were available on the national scale. The action ability, however, turned out to be limited because most options on a national scale did not appear to be feasible: they required large scale adjustments to the infrastructure. So, most options were present on a regional scale, limited options remained and the perception of the action ability decreased. The *design and recommend* objective was, then, only partly achieved. The spatial boundary setting contributed to putting the problem on the agenda of the national political actors, but it did not help to put the water shortage issue on the agenda of the regional political actors.

Effects of the spatial boundary setting
Table 7.12 shows an overview of the effects of the spatial boundary setting and the related perspective. This table shows that the spatial boundary setting in the WSS had effects related to all rationalities.

Table 7.12: Overview of the types of effects of spatial boundary setting mentioned and/ or observed in WSS

Effect	Clustered effect	Related rationality
Scientific validity Ability to locate the problems Insight in key parameter (national water distribution)/ Insight into the system/ Insight in problem Insight into relation: main water system-regional water system/ Understanding the interdependencies	Validity of the study	Scientific
Inclusion of issues	Content (problems, options and effects)	
Fine-tuning possibilities Possibilities for overall economic optimisation	Optimisation possibilities	
Willingness of actors to get involved Commitment Dedication of actors I ????? Interest of the actors involved Resistance of actors involved	Commitment	Political
Possibility to schedule the problem/ Awareness raising	Awareness	
Availability of options Coherence of options Broadness of options	Broadness and coherence of analysis, options and effects	Design
Presence of options with large effects	Effectiveness of options	
Solvability of the problem Action ability	Action ability	
Shift ability of the problem	Shift ability of the problem	
Flexibility	Flexibility	
Ability to manage Feasibility Knowledge availability/ research man power	Manageability	Managerial
Focus on the agenda	Focus on the agenda	

Although a lot of arguments related to the effects of the scale choices, some of the arguments were related to boundary conditions that were present at the start of the policy analysis process or contextual conditions in which the scale choices had to fit at the end of the study:

- Model availability
- Match with other issues (water flooding also studied on that scale)
- Uniformity/ synchronicityof policy

Similarities and differences in actor perspectives

Although in the WSS different preferences about the selection of the spatial scale were present, the consequences that the actors attached to the scale choice were not critical. This can also be seen in the actor analysis that was executed before the project started: many regional actors responded that they were not interested in a study on a national scale, but they did not object to it. For them it was clear that they would not participate in the study. So, by selecting a national scale, the commitment of the regional actors involved seemed to be initially limited.

7.4. Cross-case comparison

Similarities and differences
Table 7.13 presents an overview of both case studies.

Table 7.13: Overview of the spatial boundary setting in the LTV and the WSS

	Long-Term Vision, Scheldt Estuary	Water Shortage Study
Spatial boundaries	Transboundary, regional	National, but regional taken into account as well
Controversial issue?	Yes	No, some regional/ local actors preferred another scale for the study. They did indicate that they did not want to get involved in a study at the national scale, so they did not, at first
Scale choices decision making	Multi-actor oriented. Scale preferences were discussed in a workshop. Scale selection forced by one actor involved (Port of Antwerp)	Single-actor oriented. Scale selection based on level of influence, commissioner of the study
Effects mainly related to	Scientific, political, design and managerial rationality	Scientific, political, design and managerial rationality

In policy analysis with multiple goals, it appears difficult to make scale choices in such a way that they contribute to the achievement of the objectives of the study. With spatial boundaries selected for both studies, those boundaries did not contribute to the objective *design of policy options*. In the LTV, the selection of a 'small' scale led to limited options and one could conclude 'premature closure'. In the WSS, the selection of a 'large' scale led to limited options, because most options were present at the regional scale.

In both cases, scientific validity was not negatively influenced, although the selected scales did not match with the system boundaries. The reasons were different, however: in the LTV, the selected spatial boundaries were adjusted in the scientific studies; in the WSS, no adjustments were necessary because the water system in the Netherlands is man-made.

In both cases, the regional actors had little interest in the progress of the project although the reasons for this were different. In the LTV, regional actors wanted to get involved because they were opposed to the deepening. The only regional actor that was actually involved was the province of Zeeland. In the WSS, a lot of regional actors did not consider the problem urgent enough to get involved at the start of the study.

A lot of similar effects were present in both cases. Examples of factors affected by the spatial boundary setting that were visible in both cases can be seen in Table 7.14.

Table 7.14: Similar types of effects of the spatial boundary setting mentioned or/ and observed in the LTV and WSS

Effects	Rationality
Validity of the study Content of the study	Scientific
Commitment	Political
Action ability Broadness and coherence of analysis, options and effects	Design
Focus on the agenda Manageability	Managerial

One difference between the actor's involvement was in the selection of the spatial boundaries. The LTV was multi-actor oriented; scale preferences were discussed in a workshop. The WSS was single-actor oriented. The scale selection was based on the level of authority of the commissioner of the study.

Also, clarity about the definition of the boundaries was different. In the Water Shortage Study in which the spatial scale was specified by the geopolitical boundaries, clarity was present at the start about the actual spatial boundaries: the state borders of the Netherlands. In the Long-Term Vision, it appeared that an area addressed as 'estuary' may seem rather specific at first, but different perspectives existed related to whether the definition of the estuary was based on the tidal difference or on the saltwater intrusion.

Another important difference between the LTV and WSS studies was the urgency of the problem. In the LTV, the urgency was very high and therefore the dedication of actors was clear. This also showed that when the urgency of problems is unclear, actor analysis diagrams are more difficult to construct. The selected scale, in that case, was not the only varying factor but so was the perceived urgency of the problem.

Another important difference between the LTV and the WSS is the controversy concerning the selection of the spatial boundary setting. Many alternatives seemed to exist in the LTV. The controversy can also be seen in the number of arguments that have been mentioned. In the LTV there were many arguments, while in the WSS fewer arguments are given. In the LTV the selection of the spatial boundaries was regarded to be quite controversial because a lot of conflicting political interests were present. In the LTV, the outcome was going to be influenced by the spatial scale: alternatives for the deepening would either be taken into account or not. In the WSS competing interests could be recognised. All actors involved wanted the same thing: sufficient water to suit their needs. However, the water shortage issue was not considered to be very urgent so their competition did not lead to conflicts (at least none yet).

The way that the interactions between the different scales were handled differed too. In the WSS, the issue of different spatial scales played a very important role. Therefore, in the WSS, interactions between the different scales (especially the national and the regional) were given attention throughout the study while in the LTV, differences in scale were occasionally attended to (economic studies). In the WSS, from the beginning, it was clear that not many policy options were present at the national scale and that the regional scale had to be involved. Also, on the river basin scale, additional options would have been present. Often, it is considered that the number of options increases if a large spatial scale is taken into account. In the Water Shortage Study this appears not to be the case.

Examples of factors affected by the spatial boundary setting that were visible in only one case are presented in Table 7.15.

Table 7.15: Types of effects of the spatial boundary setting that are only mentioned in one case study

Case study	Effect	Rationality
LTV	Possibilities for consensus building Openness Protection of interests	Political
	Justifiability Policy relevance	Design
	Efficiency Progress	Managerial
WSS	Optimisation possibilities	Scientific
	Awareness	Political
	Effectiveness of options Ability to shift the problem Flexibility	Design

As could be expected, in the LTV, more criteria that are related to the political and managerial rationalities played a role.

Reflection on the key questions

The key question in the LTV was how to select spatial boundaries in such a way that an urgent problem is central on the agenda. The LTV learned that it is important to limit the spatial boundaries to the urgent problem as much as possible, exclude delicate issues and conflicting actors as much as possible, take into account just what is needed and make sure the spatial boundaries are large enough to find plausible solutions.

The key question in the WSS was how to handle cross-scale interactions. The WSS showed that when a lot of interactions between different scales exist, a multi-scale analysis approach is helpful to address these interactions and take them into account.

8. Studying the effects of the temporal boundary setting

The advantage of a longer term is that you can think more freely. You can think of solutions that can never logically follow from extrapolation, because extrapolation is not possible anymore. The longer the term you use, the less obvious extrapolation becomes.

-Pers. com. Commissioner, Long-Term Vision of the Scheldt Estuary, 2004

If you start working on a longer term, this also has implications for the type of people who are involved in the study. Often, people are involved that are less practical, and more strategic.

-Pers. com. Policy analyst, Water Shortage Study, 2005

8.1. Introduction

In this chapter, the effects of temporal boundary setting are studied in the two cases, the Long-Term Vision of the Scheldt Estuary (LTV) and the Water Shortage Study (WSS) of the Netherlands. The main goals are to get closer insight into what the effects of the temporal boundary setting are in practice and how the temporal boundary setting frames a study.

In the LTV, the temporal boundary setting appeared to be a controversial issue because the Flemish had an urgent issue at stake: they wanted the deepening to take place preferably as soon as possible, while the Dutch highly valued the ecological system of the Scheldt Estuary. Therefore, the interesting question playing here was how to construct a long-term vision while an urgent issue was at stake. The temporal boundary setting of the analysis scale was studied to see how this dilemma was handled.

The problem in the WSS seemed to be exactly the opposite problem in the Long-Term Vision. In that study, a short-term problem was the motivation to start a long-term study. The Water Shortage Study, on the other hand, used a long-term study to place the issue of water shortage on the short-term agenda. Water Shortage was, at the moment the Water Shortage Study started, not really felt to be a problem. Water flooding received much more attention because it was considered more urgent. Water shortage was considered to be mainly a long-term problem because, when summers get drier in the future due to climate change, water shortage situations might occur much more often than today. The interesting question in this matter was, therefore, how to place a long-term problem on the short-term agenda. The temporal boundary setting of the analysis scale was studied.

Key questions:
- *How to construct a long-term vision of an urgent problem?(LTV)*
- *How to place a long-term problem on a short-term agenda?(WSS)*

In the sections that handle the case studies, first the selected temporal scale is analysed by constructing a system diagram in which the variables taken into account, the exogenous factors, options to be included and the outcomes of interest, are illustrated. Also, an actor analysis diagram is constructed in which the dedication and criticalness of the actors involved is indicated and explained. Next, a thought experiment was conducted in which alternative temporal boundaries are now discussed. The alternative temporal boundaries were plausible alternatives that at least one of the actors involved mentioned as an interesting alternative. The results of the thought experiment are described in two parts: one part presents the system diagram and the actor analysis diagram for each alternative temporal boundary, and another part in which values are attached the present the actors' perspectives.

To make the system diagrams and the actor analysis diagrams, the representative diagrams of the selected temporal boundary are always used as a starting point. Their differences within each selected temporal boundary are clearly highlighted.

In the system diagrams of the scale alternatives, changes compared to the original system diagram are presented as follows:

- Additional variables, options and arrows are marked in **bold**
- Variables, options and arrows that do not play a role are marked in grey

In the actor analysis diagrams of the scale alternatives, changes compared to the original actor analysis system diagram are presented as follows:

- New actors are marked in italics and underlined
- Actors that change positions (dedicated, critical) are marked in italics

The data are based on interviews with the actors involved, and my own observations and analysis. Also, the actors' perspectives on the different alternative temporal boundaries are presented; these are based solely on the interviews with the actors involved.

Next, the most important observed effects of the selected temporal boundaries are summarised. These effects were observed by the actors involved and me. To prevent the list of effects from becoming a heterogeneous list of all kinds of effects, a causal diagram has been constructed in which tentative causal relations between the effects are drawn.

The last section of the chapter shows a cross-case comparison in which the results of the two case studies are compared and the similarities and differences are explained. Finally, a reflection is given on the key questions that are presented above.

8.2. Long-Term Vision of the Scheldt Estuary

8.2.1. Analysis of the selected temporal boundaries

As presented in Chapter 5, the Long-Term Vision was developed for the year 2030. The years 2005/2010 were also taken into account in the backcasting to be able to design options to reach the target set in 2030.

Systems analysis

To be able to construct a system diagram it is important to understand the important variables and processes that play a role. As could be noticed in Chapters 5 and 7, four types of processes are thought to be important in the LTV: morphological, ecological, economic, and processes concerning safety. When using 2030 as the term for the long-term vision, these processes all play a role. Although for economics 2030 is quite far away, the return on investment can be taken into account at this term. Although for large-scale morphological and ecological processes 2030 is quite soon, their effects are expected to become just visible at that term. So, the same system diagram as was constructed for the selected spatial boundary can be used. In Figure 8.1, these processes are depicted in a system diagram.

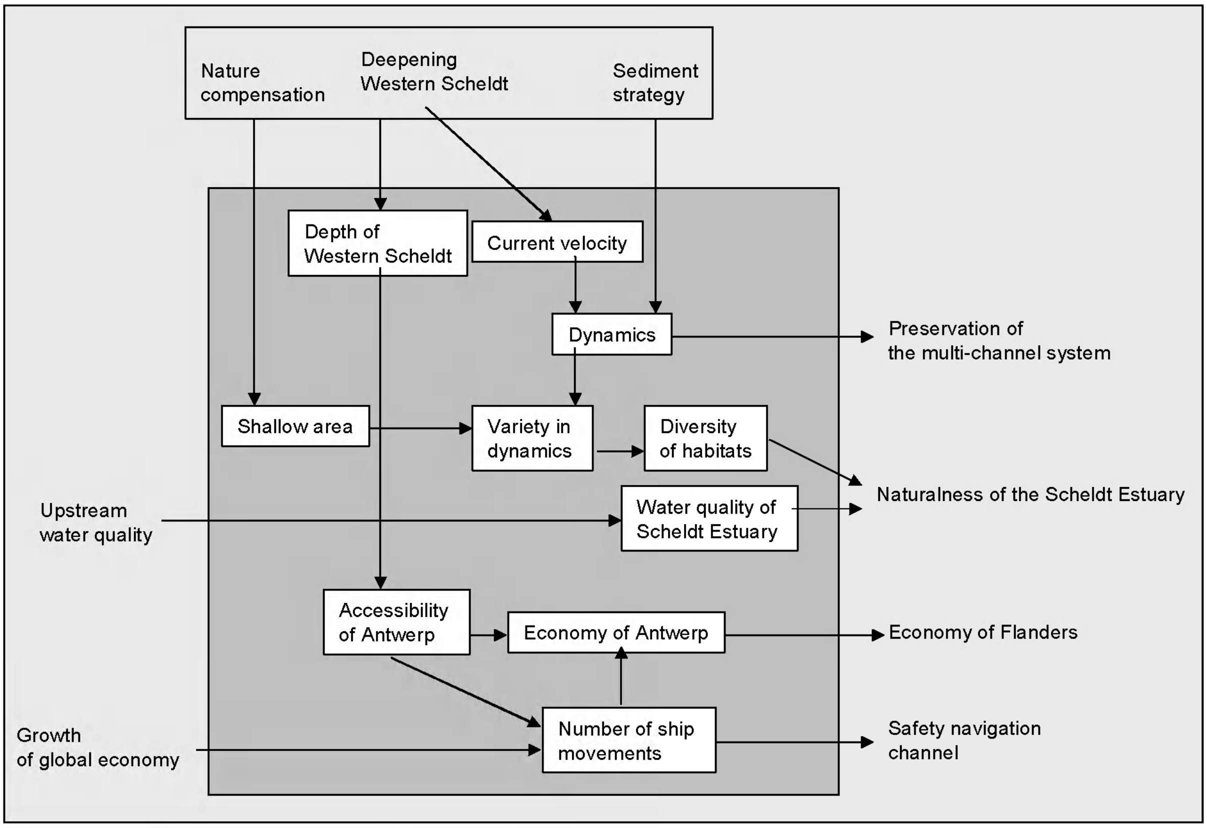


Figure 8.1: System diagram of 2030, LTV

Actor analysis

Almost all actors involved were dedicated to the problems that were on the agenda when using this temporal scale: the deepening as a key issue together with morphological, ecological and safety aspects. They all recognised the importance of the issues and the necessity of solving them. Not all actors, however, were critical in the sense that they needed to be included in order to solve the problem. Table 8.1 shows an overview of the results of the actor analysis. Most governmental actors are considered to be critical except the regional and local ones. This is also related to the high level of aggregation that was used in the problem analysis that was related to the large temporal scale. It can be noticed that the actor analysis diagram for 2030 is the same as the actor analysis diagram for the selected spatial boundaries.

Table 8.1: Actor analysis diagram of 2030, LTV

	Critical actor	Non-critical actor
Dedicated actor	Dutch Ministry of Transport and Water Management Ministry of the Flemish community Technical Scheldt Commission Port of Antwerp AMINAL	Province of Zeeland Municipalities in Zeeland Agricultural organisations Tourism organisations Nature organisations
Non-dedicated actor	-	-

Actor perspectives

The actors mentioned a number of arguments in favour of 2030 and only few arguments against it. Arguments that were used by political actors, commissioners and policy analysts in favour of this alternative include the fact that it is often used in vision building because it is looking one generation ahead, and that consensus building on this temporal boundary is easier. A policy analyst noted that the time scale should be selected in such a way that it is realistic, feasible and surveyable. The year 2030 was the option that met these demands. A commissioner argued in favour of 2030, saying that the right balance was found because it is just far enough ahead not to be occupied with how to reach it and, on the other hand, it is quite soon.

The morphologists did not regard 2030 as a suitable temporal boundary because they found it hard to make predictions on this temporal boundary. Typically, they are able to work with detailed models on short temporal boundaries or with very abstract models with a horizon of hundreds of years, but they do not have a model available that can predict the situation in between. A paradoxical dilemma exists that is comparable to weather forecasting. A clear distinction can be made between weather forecasting models and climate forecasting models. With weather forecast models it is possible to predict the weather tomorrow, the day after tomorrow, and something can be said about the weather in five days. It is pointless to ask what the weather will be in three months. The morphological process-based models are able to predict water movements and sand transport in a very detailed way by using process-based models to make quantitative predictions. They have a predictability range of about 5 to 10 years. On the other hand, there are models like the climate prediction models that can say something qualitatively 50 to 100 years ahead.
What does the morphological system look like, roughly? Different questions are addressed: not on the exact location of the channel but, for example, about how many channels are expected to exist? Thirty years falls outside these prediction ranges, so no adequate approaches exist for those horizons.

One of the morphologists remarked:

> *When you ask us about the morphological situation in detail about thirty years, it is the same as the question what the weather will be like on June 6, 2010. The temporal boundary is rather arbitrary. 2010, 2030 and 2050 are for us all short term. Thirty years seems very long, but we look 1000 years back. We look at the development of the system. From 1000 to 1500 the system has increased, from 1500 the system has become smaller. The multi-channel system that we see now is still a response to those developments. When you talk about the entire morphological system, you automatically talk about temporal boundaries of hundreds of years.*

He is the first actor to address a relationship between the temporal and the spatial boundaries when discussing 2030, because he argued that 2030 does not match with the selected spatial boundaries. Apparently, in morphology, the match between spatial and temporal scales plays an important role.

An economist thought that, although it is almost impossible to make economic predictions on a term of 30 years, it is important to be able to take the return on investment into account because costs and benefits have to be estimated on a scale of 20 to 25 years, even though the uncertainties are very high:

> *It is difficult to predict economic processes more than five years ahead. At the moment the economic prognoses were made, we expected a large growth in transported goods. Now, five years later it appears that the volume of transported goods has increased a lot more than anyone expected and entirely new technology is available to build much larger ships, so five years later the prognoses are already not valid anymore.*

For a complete overview of all the criteria mentioned in favour of and against the selected temporal boundaries, refer to Appendix 6.

8.2.2. Thought experiment

Design of the thought experiment

In the thought experiment, two alternatives were discussed which are mentioned in Table 8.2. The concept of the thought experiment was explained in section 4.5.2.

Table 8.2: Alternatives studied in the LTV temporal boundary setting thought experiment

Larger temporal scale	Smaller temporal scale
≥ 2050	2010

The year 2050 is mentioned as a good alternative by the morphologists, and 2010 by the political actors in favour of the deepening.

Results of the thought experiment

≥ 2050

Systems analysis
The emphasis of the study is expected to be different when using this time scale. The focus of the study is expected to shift to the morphological and ecological processes which tend to play on larger temporal scales. The reason for this shift in focus is that it is expected to take a long time before effects on the morphological and ecological systems become visible. The dynamics of the system is an important variable in this matter: large-scale morphological processes and large-scale ecosystems processes have slow dynamics. At 2050, the effects of deepening on the physical system would be visible. A shift in emphasis would not lead to any changes in the system diagram. The deepening and the related economic processes are still issues on the agenda because they are the reason the study was started in the first place.

The only real change in the system diagram is the possibility of including uncertainties like climate change when using this temporal boundary. When including climate change, it can be expected that the focus of the study will shift a little because also flooding risks due to climate change will start to play an increasingly important role. In Figure 8.2, the changes have been added to the system diagram.

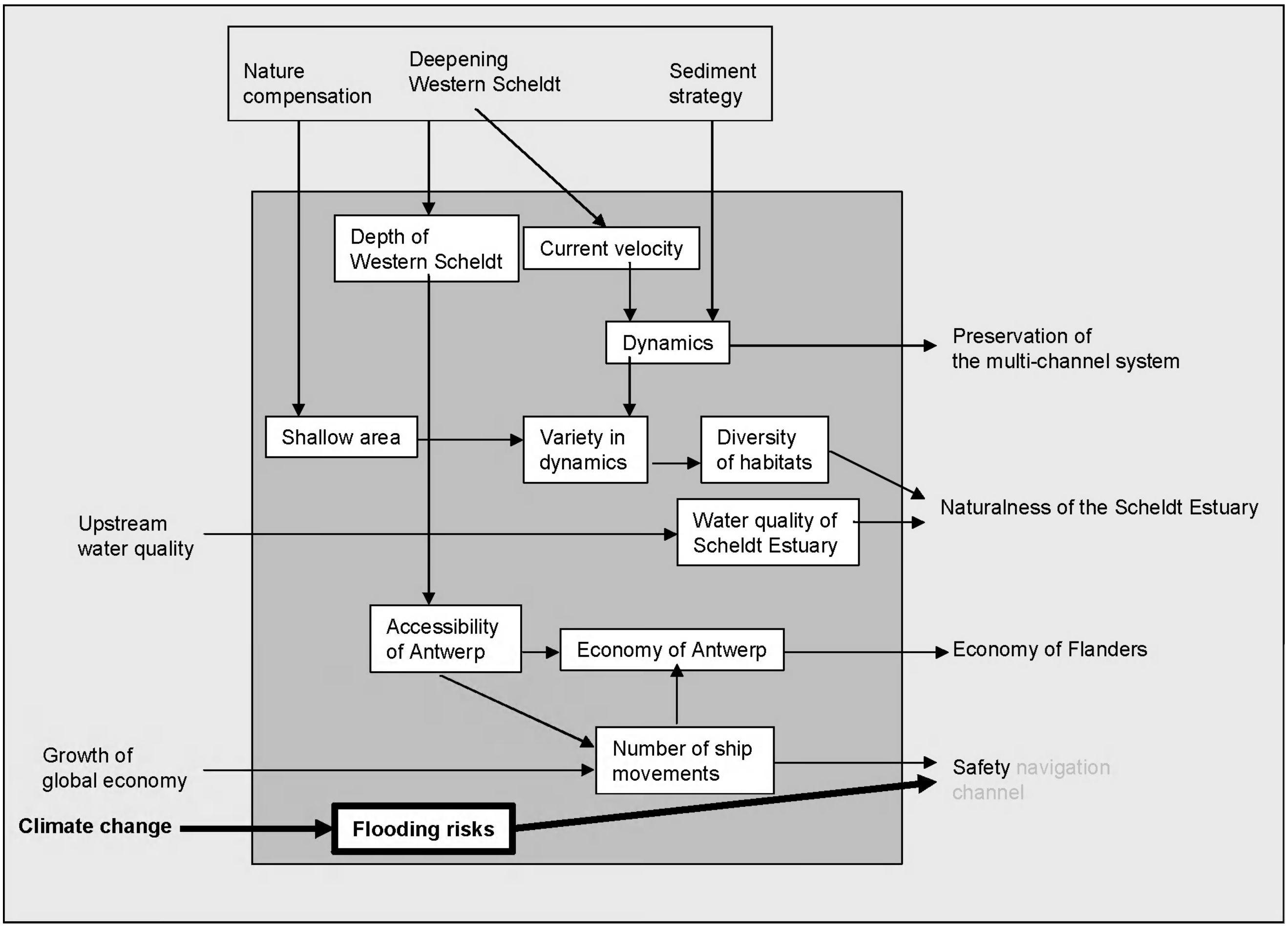


Figure 8.2: System diagram of ≥ 2050, LTV

Actor analysis

Table 8.3 shows an overview of the results of the actor analysis. Although the time scale is very long, all political actors are expected to be dedicated. Although other issues like morphology and ecology play a more important role, the deepening is still an issue on the agenda. So, no changes compared to the initial actor analysis diagram are expected.

Table 8.3: Actor analysis diagram of ≥ 2050, LTV

	Critical actor	**Non-critical actor**
Dedicated actor	Dutch Ministry of Transport and Water Management Ministry of the Flemish Community Technical Scheldt Commission Port of Antwerp AMINAL	Province of Zeeland Municipalities in Zeeland Agricultural organisations Tourism organisations Nature organisations
Non-dedicated actor	-	-

Actor perspectives

Most actors agree that there is a boundary attached to 'long term' and that 2050 exceeds that boundary. It is considered very difficult to say something that would make sense about such a long term. Climate change is often used as an example of uncertainty that would be a complicating issue in this situation and should not necessarily be the focus issue. If a large temporal boundary would have been selected, the effects of climate change are expected to be considerably greater. A policy analyst thought the governmental relevance of 2050 would be too limited. According to him the temporal boundary selected should be based on governmental relevance: one generation is the maximum humans can think ahead.

Although most actors mainly see arguments against ≥2050, some actors see some arguments in favour of this alternative. A political actor against the deepening thought that it would be easier to agree on this time scale. A commissioner thought that working with a temporal scale of 2050 would stimulate creativity because it would force people to think 'outside the box':

> *The advantage is that you can think more freely. You can think of solutions that can never logically follow from extrapolation, because extrapolation is not possible anymore. How far ahead you go, extrapolation becomes less obvious. If I look fifty years back from now, you can see my point. Then you can provide arguments to let the people think more broadly.*

A morphologist thought that the temporal boundary would do justice to the term at which the effects are expected to become visible:

> *We did an exercise to calculate the worst case scenario, namely when the multi-channel system becomes a single channel system. Well, that process takes 1000 years. It is possible that one tendency switches to another tendency and that we are unable to observe that signal because a lot of noise exists as well. If you look back, you can see that there has been a turning point. The measures that we take now in the system are a ripple on what the humans have been doing since 1500. Partly human influences (de-poldering and deepening) played a role and partly natural development of the system.*

For a complete overview of all the criteria mentioned in the thought experiment in favour of and against this alternative, refer to Appendix 6.

2010

System analysis

At the time the study started (1998), 2010 was more than a decade away. Political processes have their own dynamics which are often faster than the dynamics of physical processes. The year 2010 was already considered long term in view of the dynamics of election periods (4-year cycles) because 2010 could have been considered as looking three election periods ahead. Also, from the point of view of economic processes, 2010 seemed to be a term on which predictions could be made. On such a short time scale, the economic processes would be emphasised. Had 2010 been selected, more focus on the accessibility issue would have been present. The morphological and ecological processes would have faded into the background. Therefore, the system diagram focuses only on the deepening and the related economic processes, as can be seen in Figure 8.3.

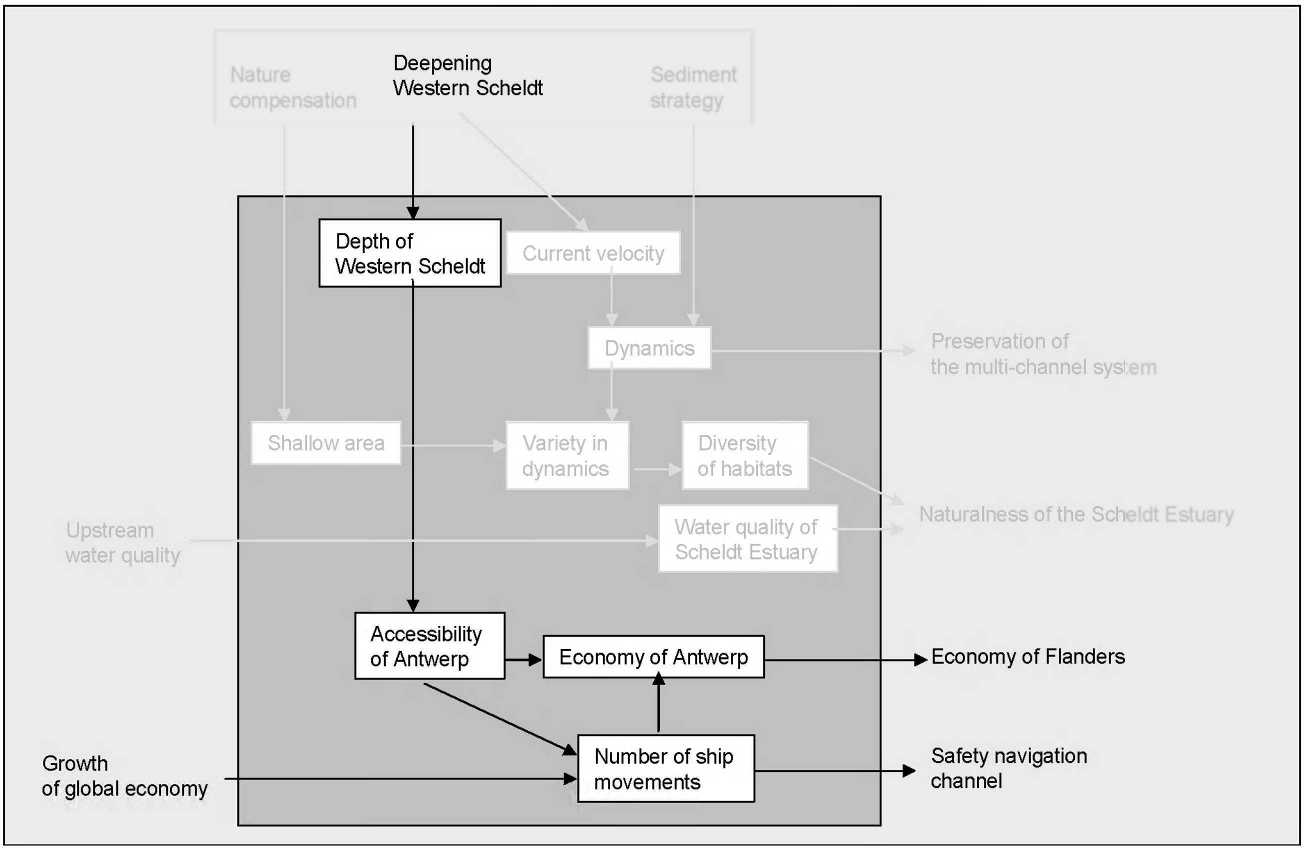


Figure 8.3: System diagram of 2010, LTV

Actor analysis

The deepening was becoming even more central on the agenda so it could be argued that the actors that were more interested in the ecological issues would become less dedicated when these temporal boundaries were used. However, this was not expected to be the case because the nature organisations were always very worried about the environmental impact of the deepening and were therefore expected to stay dedicated even on this short time scale. Also, it was expected that they would become even more dedicated to convince other actors involved that effects should be studied on a longer term. So, the actor analysis diagram for 2010 was expected to be the same as the actor analysis diagram for 2030 that is presented in Table 8.1.

Actor perspectives

The actors had very different views about 2010. Most actors found this temporal boundary rather limited for a number of reasons. There was little challenge to address and overcome differences of opinion; a limited set of options came into the picture; it was not possible to create an ambitious, far-reaching vision; and, it was not possible to calculate the return on investment were all frequently mentioned arguments. However, also some arguments in favour of 2010 were mentioned. The definite sense of urgency and the possibility to talk about actual projects were seen as advantages by the policy analysts. The political actor in favour of the deepening mentioned many arguments in favour of this alternative: better able to oversee the period, actual projects, sufficient for the beginning and good match with economic processes. This was not unexpected because his interests would be served best with the selection of 2010. The political actor in favour of the deepening even had a nickname for the Long-Term Vision: he and his colleagues called it the ‘Long postponement vision’. They thought that 2010 would have been sufficient for the beginning considering the urgent interest of the deepening that was at stake and that had to be resolved as soon as possible. A political actor in favour of the deepening explained the urgency:

> *At the moment the LTV started, we would have liked the deepening to take place in 2003-2004. It is very urgent, because some shipping companies are almost bankrupt. Now we expect the deepening to take place in 2006-2007.*

For a complete overview of all the criteria mentioned in the thought experiment in favour of and against this alternative, refer to Appendix 6.

Conclusion of the thought experiment
The temporal boundary setting in the LTV did not have an impact on the types of actors involved nor on the dedication or criticalness of the actors involved. This was because the deepening always would remain an issue no matter what time scale was selected and that the actors with an interest in the naturalness of the estuary would always be dedicated no matter what time scale was selected.

8.2.3. Summarising the effects of the selected temporal boundaries

The selected temporal boundary was 2030 but 2010 was taken into account as well. The focus on 2030 made it possible to include a broad and coherent set of issues in the study. The creation of a vision for 2030 made it possible to include a combination of aspects (economy, ecology, morphology and safety) and to serve both ecological and economic concerns. Because of the wide temporal boundaries, more options could be included because long-term structural solutions could be included as well. The selection of 2030 also made it possible to include options with long-term effects that were not a logical follow-up to the current measures, like nature compensation through restoration of the connection between the Western Scheldt and Eastern Scheldt. In addition, effects that occur in the long term, like structural environmental effects, could be studied.

The selected temporal boundaries also provided possibilities for issue trade-offs because of the inclusion of both economic and ecological aspects, and options for the preservation of the ecological system. The Dutch emphasised the ecological aspects and could set goals on that matter, while the Flemish emphasised the economic aspects. The large temporal boundaries made it possible to overcome short-term differences so it contributed to preventing conflicts caused by their different interests. Most actors involved stated that a study on a shorter term would have resulted in more conflicts related to current interests. Because 2030 was selected, it was not possible to make a very concrete vision; discussions took place on a rather high level of aggregation. This contributed not only to consensus building but also made it possible to finish on time. Some actors thought that the creation of a vision for 2030 took less time than a vision for 2010 because fewer conflicts were expected on concrete measures. Although the wide temporal boundaries caused an increase in the uncertainties involved, it did not affect the progress. An argument that was used against the large temporal boundaries in the beginning of the study was that more uncertainties would need to be addressed should 2030 be selected, and that might take more time. This appeared not to be the case because the study was executed in a very early phase of the policy process. For this stage it was often sufficient to identify the uncertainties and not think the effects through because a follow-up phase would be organised in which the uncertainties could be studied more closely.

Involvement of the limited temporal boundaries contributed to creating a large sense of urgency and therefore also to protecting the interests of the Port of Antwerp. However, the Port of Antwerp stated to be rather unhappy with the selected temporal boundary setting because they thought 2030 was too far away. As mentioned in Section 5.4, also other temporal boundaries were introduced because the researchers adjusted those boundaries in order to be able to conduct scientifically valid studies. This caused a decrease in the coherence of the study during the process. The integration of the different time scales in the end was perceived to be difficult by the policy analysts involved, as stated in Section 5.4. Although the individual researchers thought that for the disciplinary studies adjustments were needed, some actors involved thought that linking information from the different time scales was like comparing apples and oranges and would, therefore, reduce the scientific validity of the overall study. One of the economists stated:

> *The approach has strengths and weaknesses. An important strength is the political persuasion power of the study because all aspects are included. If you look at the study from an academic point of view, you are comparing apples and oranges. Disciplines of economics, morphology and ecology have different temporal boundaries, different content, different costs and benefits, different angles. This is all brought together and conclusions are drawn on adding a, b and c. I am not in favour of integration if all those aspects are so very different. You should look at the aspects separately and judge them separately. Do not try to link it. Linking does not make an integrated vision because it is always a compromise.*

Figure 8.4 summarises the effects of the temporal boundary setting in a causal diagram.

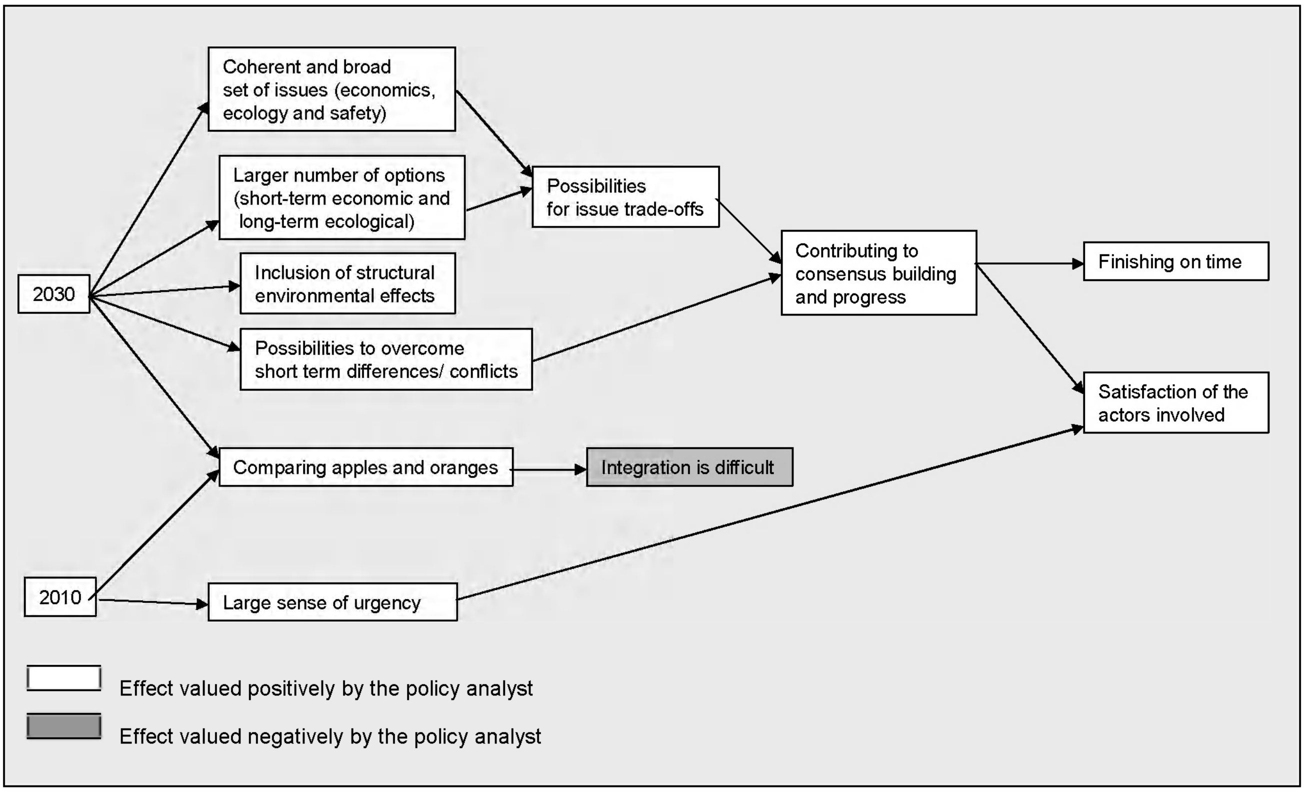


Figure 8.4: Causal diagram of effects of temporal boundary setting in the LTV

8.2.4. Concluding remarks

Contribution of the temporal boundaries to the achievement of objectives of the study
The combination of two temporal boundaries (2010 and 2030) contributed to the success of the study. Most actors concluded that the study could be conducted on a more aggregated level because of the long term of 2030 that was considered. The higher level of aggregation contributed to the possibilities of consensus building. Also, the inclusion of the long term made it possible to overcome short-term differences and prevent conflicts about short-term measures. This combination of temporal boundaries contributed to the success of the study because those boundaries would allow an ambitious, sustainable vision to be made while at the same time securing the sense of urgency and the action ability, contributing to the objective *mediate*. In this way the best of both alternatives was combined and resulted in a better choice. There had been some discussion in the beginning, but it was agreed upon quite quickly.
A lot of actors involved, therefore, did not consider the temporal boundary setting a controversial issue. This was an important contribution of the policy analysts. They considered the choice between 2010 and 2030 to be a difficult trade-off because of the conflicting interests and the critical effects attached to it for the actors involved. They tried to reconcile the disparate views by proposing a combination of different temporal boundaries in the study as a compromise. This appeared to be an excellent manoeuvre to extract the sting from the debate in a very early phase and in this way avoid conflicts about this decision. The temporal boundary model became, later on in the project, a kind of icon of the project: the picture (see Figure 5.4) was used by a lot of actors to explain the project to outsiders.

Effects of the temporal boundaries
Table 8.4 provides an overview of the effects of the temporal boundary setting and the related perspective. This table shows that the temporal boundary setting in the LTV had effects on the research, process, project and design characteristics.

Table 8.4: Overview of the types of effects of the temporal boundary setting in the LTV

Effect	Clustered effect	Related rationality
Validity of the study Match with economic, morphological processes Prediction possibilities (for economics, ecology) Possibilities to verify predictions Possibility to address the underlying problems Visibility of effects Match between spatial scale and time scale Amount of uncertainties	Validity of the study	Scientific
Possibilities to calculate return on investment	Return on investment	Scientific
Protection of interest	Protection of core values	Political
Possibilities for consensus building Possibility to overcome short-term differences Number of issue trade-offs	Possibilities for consensus building	Political
Sense of urgency	Sense of urgency	Political
Oversee ability	Oversee ability	Political
Governmental relevance Economic relevance Safety relevance	Policy relevance	Design
Number of options Broadness of issues Coherence of issues Broadness of effects	Broadness and coherence of analysis, options and effects	Design
Creativity	Creativity	Design
Justifiability	Justifiability	Design
Realisation possibilities of solutions Decision-making ability	Action ability	Design
Match with objectives of study Possibilities to fulfil ambition Effectiveness	Effectiveness	Managerial
Finishing on time	Efficiency	Managerial

Although many arguments were related to the effects of the scale choices, some of the arguments were about the boundary conditions that were present at the start of the policy analysis process or contextual conditions in which the scale choices had to fit at the end of the study:

- Match with other, similar projects
- Match with phase of the process

The thought experiment showed that the selection of time scale did not have an impact on the involvement of the actors nor on the dedication or the criticalness of the actors involved.

Similarities and differences in actor perspectives

The variety in criteria that is mentioned by the actor archetypes is large. The validity of the study is the only criterion that was considered important by all actor archetypes. A sense of urgency was considered important by all actor archetypes except the researchers.

Criteria mentioned by two actor archetypes in each category were:

- Action ability (commissioner, policy analyst)
- Broadness of options (commissioner, policy analyst)
- Match with objectives of study (political actor, policy analyst)

- Match with other, similar projects (commissioner, policy analyst)
- Match with the phase of the process (political actor, commissioner)
- Possibilities for consensus building (political actor, commissioner)
- Prediction possibilities (political actor, researcher)

8.3. Water Shortage Study

8.3.1. Analysis of the selected temporal boundaries

In the WSS, instead of a selection for a single scale, two temporal boundaries were used: one for the short term (2015) and one for the long term (2050), based on the facts that 2015 is an important year in the entire WB21 process and 2050 is important to be able to take into account climate change.

Already in the project plan, a distinction was made between products of the study for the short term and for the long term. For the short term, the study had to deliver protocols on how to handle the water in periods of water shortage (RIZA, 2001). Also, the project had to create a sense of urgency. For the long term, the study had to provide sound policy options in which the infrastructure or the use of the infrastructure was adjusted to anticipate future periods of water shortage (RIZA, 2001).

The two selected alternatives, 2050 and 2015, are discussed separately. Because these alternatives already include the short and the long term no separate thought experiment was conducted. To show the differences between the two selected boundaries, the differences are marked in bold font.

2015

Systems analysis

To be able to construct a system diagram, it is important to understand the important processes and variables that play a role. The system diagram that was constructed for the selected spatial scale (Figure 7.15) was used as a starting point. If 2015 is selected, structural options, like moving water-intensive crops, disappear and the options that can be realised on the relatively short term remain. Also, an exogenous factor, such as climate change, has less influence and therefore disappears. In Figure 8.5 these processes are shown in a system diagram.

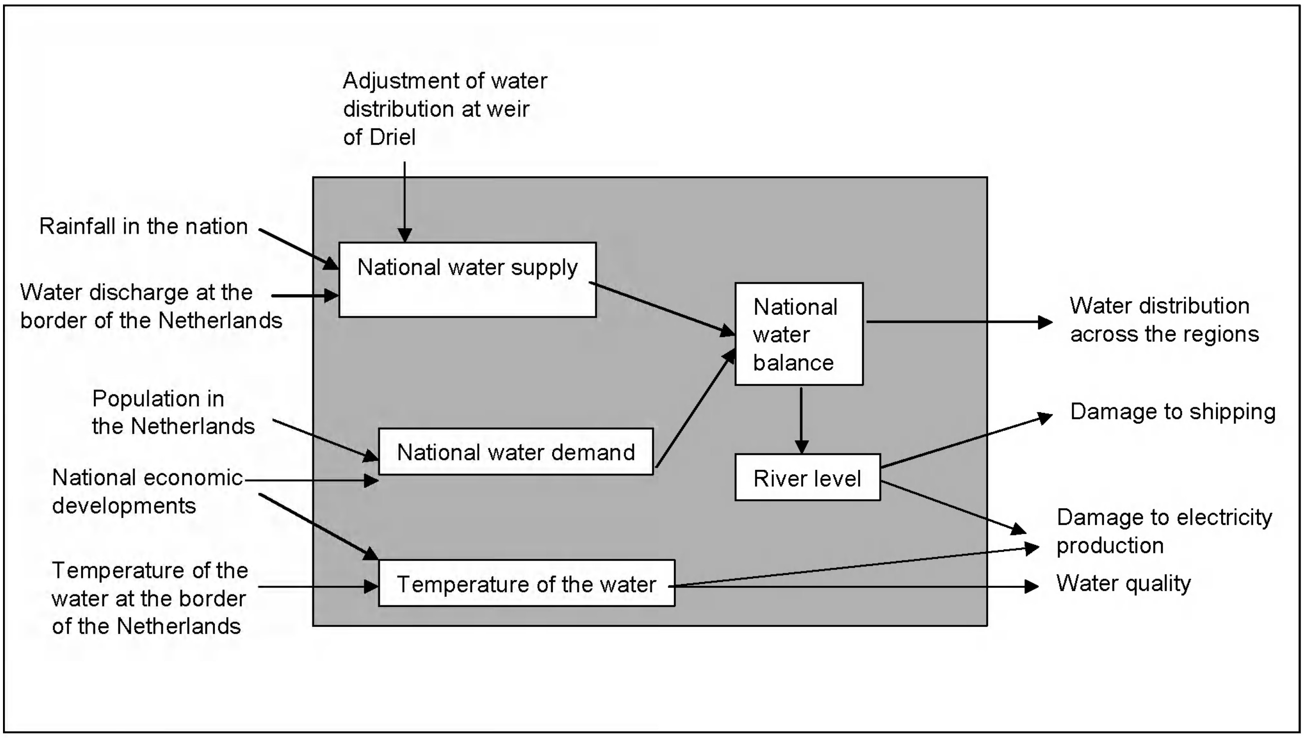


Figure 8.5: System diagram of 2015, WSS

Actor analysis

Table 8.5 shows an overview of the results of the actor analysis. The only actor involved that was absolutely dedicated to the Water Shortage Study, as well as critical, was the Ministry of Transport and Water Management. Other critical actors were the water boards, but they regarded themselves as not very critical. Often regional and local actors are dedicated when using a short term because this makes it more specific and tangible for them, but in this case they were not convinced of the urgency of the problem in the first place. Also, the wide spatial boundaries were not helpful. RIZA, the Ministry of Nature and Agriculture and EnergieNed did feel dedicated to the problem but were not critical. The other actors were neither critical nor dedicated. The Ministry of Transport and Water Management was the initiator of the study, so they were dedicated. [Your first sentence says what I deleted]

Table 8.5: Actor analysis diagram of 2050, WSS

	Critical actor	**Non-critical actor**
Dedicated actor	Ministry of Transport and Water Management	RIZA Ministry of Nature and Agriculture EnergieNed
Non-dedicated actor	Water boards	IPO VNG LTO VEWIN Municipalities

Actor perspectives
The commissioner thought that it was important to work on an overseeable scale to maintain a sense of urgency. A policy analyst mentioned the match between the spatial scale of options and the temporal boundaries as an argument to not look too far into the future:

> *Most solutions are available on a regional scale and you cannot expect that water boards use a long-term target such as 2050 to design their policy options for. Also, options must not be too pretentious. So, no long-term investments can be expected in which you need to know the return on investment in the long term. It is, however, good to take 2050 into account as a check on the robustness of the policy options proposed.*

This might imply that the dedication of actors is also influenced by the time scale and that regional actors become less dedicated when larger time scales are used. However, the regional political actors did not agree with the policy analysts on this matter. Often, it was said that 2050 was too long a term for regional political actors, but if measures are planned that have large impacts, also the regional actors consider it important to incorporate long-term effects.

The match with WB21, the EU Framework Directive-Water and the National Policy Agreement-Water were also mentioned by many actors as an argument in favour of 2015.

A policy analyst remarked that the necessity of taking the seasonal cycle into account in the modelling (a low level of temporal aggregation, so to speak) provides limitations for the temporal boundaries that can be selected. The seasonal cycle obviously plays an important role in water shortage situations. Sometimes, for example in agriculture and nature, even smaller (weekly or even daily) variations may play a role because these functions are very sensitive to water shortage.

The most frequently used argument against 2015 was that climate change does not play a role at this scale.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 6.

2050

Systems analysis
At this temporal scale, climate change was expected to play a significant role and was therefore included as an external variable. Rainfall in the nation became an internal variable of the system. Besides short-term options (like adjusting water distribution at the Driel weir),long-term structural options (adjusting the water supply infrastructure and moving water-intensive crops) were available at this term. In Figure 8.6 these processes are illustrated in a system diagram.

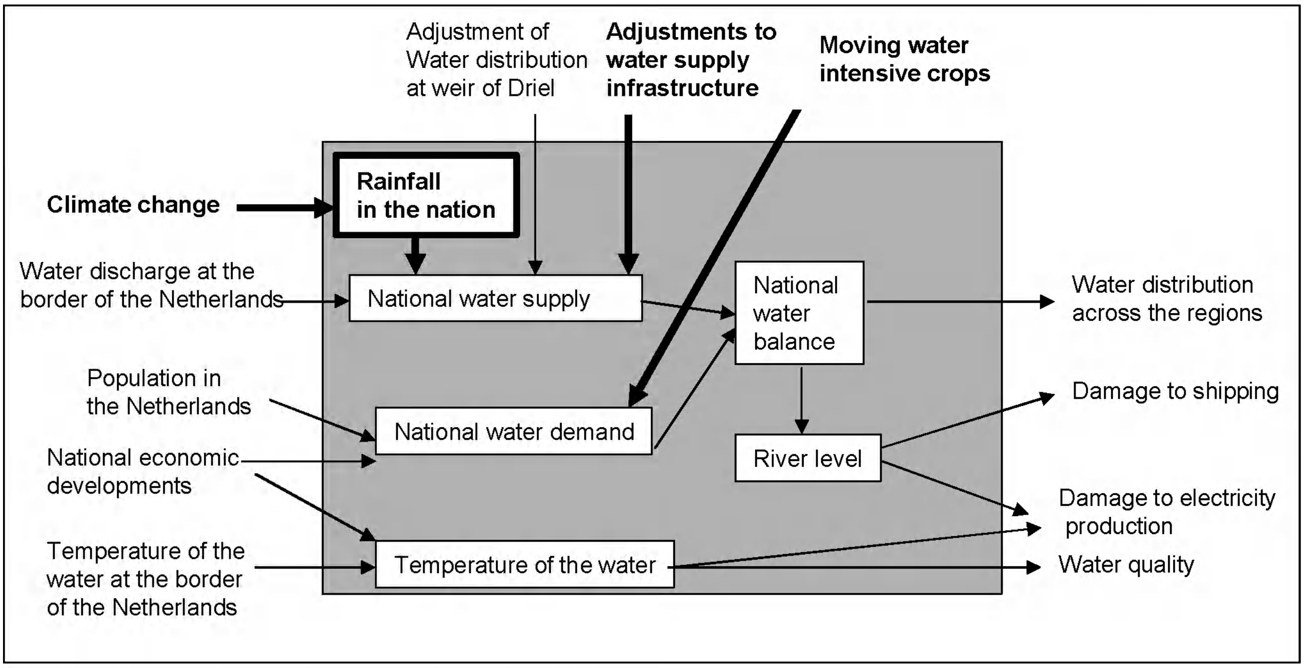


Figure 8.6: System diagram of 2050, WSS

Actor analysis
No differences were expected in the dedicatedness nor the criticalness of actors involved: the non-dedicated actors would not become more dedicated if only this time scale would have been used. The dedicated actors were expected to remain dedicated no matter which term was used. The actor analysis diagram shows the same picture as the previous one displayed in Table 8.5.

Actor perspectives
Most actors mentioned a lot of arguments in favour of addressing the water shortage problem on a long term, such as the inclusion of more issues (like environmental effects, the robustness of options, the match with large scale infrastructure planning which are long-term investments, and the possibility of taking important uncertainties like climate change into account). The inclusion of more uncertainties, however, is regarded by many as a disadvantage because model reliability declines. Other disadvantages that were mentioned are a high complexity and the reduced sense of urgency because it does not trigger any actions. Also, the risk that the problem would be shifted into the future was mentioned as an important disadvantage by the commissioners. The commissioners were afraid that people couldn't work in their daily practice with calculations of probabilities. The result is that they do nothing when the uncertainties are too large. The policy analysts agreed that the presence of uncertainties complicated the use of large temporal boundaries. One of the policy analysts said:

> *I think it is difficult to make statements about 2050, because a lot of uncertainties play a role. Climate change is of course one of them, but I think other parameters also have a lot of influence: the water demand of the different sectors is extremely difficult to predict. Large factors of uncertainty that play on such a long term are the types of ships that are used, the possible switch from fossil energy to nuclear energy, and the agricultural developments.*

A regional political actor agreed that a lot of uncertainties exist when working on this time scale and regarded it as difficult to communicate about these uncertainties to policy makers:

> *A large dilemma in my opinion is how to present uncertainties when you are dealing with long-term studies. In our regional study we used the middle scenario to present the results. Some people say that we must not communicate the uncertainties involved because the decision makers cannot do anything with that. But on the other hand, I think it is our responsibility to point out that the situation can also be worse than we expect.*

Despite the uncertainties, the policy analysts thought it was good to use 2050 as a starting point because of the large influence of climate change on the problem and the need for robust policy options. However, it was important not to focus on it too much. According to the policy analysts, it was also important to be realistic and not too ambitious in the design of policy options. In the short term, it was important to first make sure that water shortage was a criterion that was taken into account when spatial decisions were being made:

> *At the beginning of the project, one of the ideas for long-term policy options to prevent water shortage was to move water-intensive crops from the Westland to other parts of the country. However, at the moment plans are being made to extend the greenhouses in the Westland. It is important that when making such important spatial planning decisions a sufficient long term is taken into account in order to include consequences of climate change (such as water shortage) as a criterion.*

Researchers mentioned the possibility of taking reversible and irreversible effects into account as an argument in favour of using 2050. In thinking about the long term, ecological considerations become more important because the long-term consequences for nature can be included (Luiten, June 2001).

The policy analysts remarked that the temporal boundaries also have an influence on the types of representatives of the organisations that are involved. A policy analyst explained:

> *If you start working on a longer term this also has implications for the type of people who are involved in the study. Often, people are involved that are less practical and more strategic.*

For a complete overview of all the criteria mentioned in favour of and against this alternative refer to Appendix 6.

8.3.2. Summarising the effects of the selected temporal boundaries

Because of the combination of 2015 and 2050, both the incidental damage to economic sectors and the irreversible effects to nature could be addressed. Also, incidental solutions, like changing the national water distribution (weir at Driel), structural solutions, like moving water-consuming crops to parts of the country where more water is available, and adjustments to water supply infrastructure could be studied. In addition, effects that occurred on the long term, like structural environmental effects, could be studied.
The reliability of the results was limited because a lot of uncertainties were present, caused by the inclusion of the long term.

A sense of urgency was created. However, it is very doubtful whether this was related to the inclusion of 2015. The water shortage situation in 2003 was thought to have contributed the most to the sense of urgency. By including 2015, it was possible to make a match between the Water Shortage Study and the EU Framework Directive-Water, in which the river basin plans have to be prepared before 2015, the WB 21, and the terms mentioned in the National Policy Agreement-Water. Another advantage of including 2015 was the ability to act on the solutions: a shorter time scale was expected to lead to small-scale, non-pretentious options that matched better with the interests of the regional actors. Because no options for the local scale were designed during the study, action ability remained limited.

Figure 8.7 summarises the effects of the temporal boundary setting in a causal diagram.

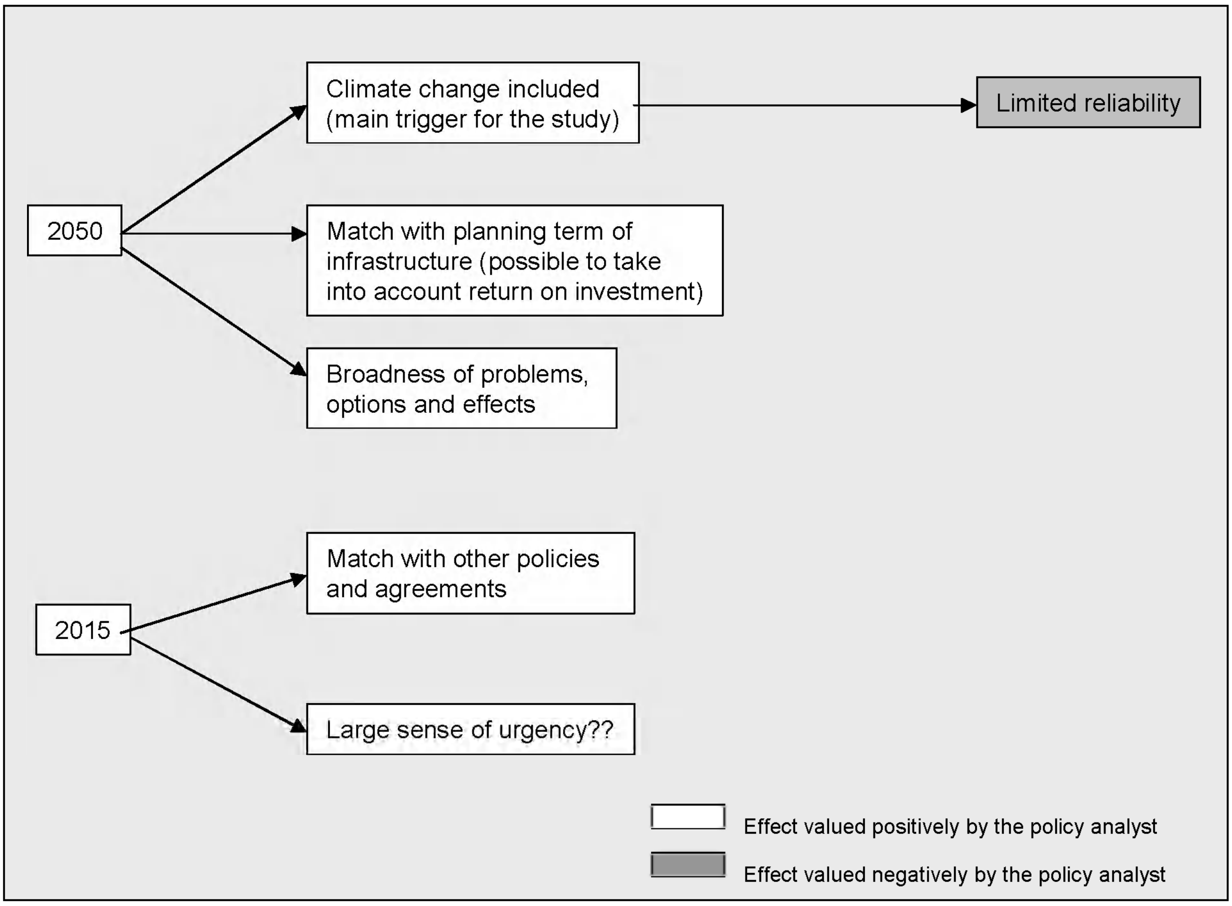


Figure 8.7: Causal diagram of effects of temporal boundary setting in the WSS

8.3.3. Concluding remarks

Contribution of the temporal boundaries to the achievement of objectives of study
The combination of temporal scales made it possible to include climate change while at the same time creating action ability. Therefore, all values mentioned in the tension bow diagram of Figure 6.5 could be incorporated. After the water shortage situation of 2003, the attention shifted from long term to short term for a while. That means that an external event increased the sense of urgency and focus on the short-term solutions. Later in the study, when it could be concluded that climate change would have an impact, the focus shifted towards the long term again.

Effects of the temporal boundaries
Table 8.6 gives an overview of the effects of the temporal boundary setting and the related perspective. This table shows that the temporal boundary setting in the WSS mainly had effects on the research and design characteristics.

Table 8.6: Overview of the type of effects of the temporal boundary setting in the WSS

Effect	Clustered effect	Related rationality
Complexity Model reliability Possibilities to take into account uncertainties Match with climate change issue Quality of the modelling results Reliability	Validity of the study	Scientific
Inclusion of issues	Content (problems, options and effects)	
Possibilities to calculate return on investment	Return on investment	
Sense of urgency	Sense of urgency	Political
Overseeing ability	Overseeing ability	
Governmental relevance Economic relevance	Policy relevance	Design
Robustness of options Possibilities to take into account regret of options	Robustness of options	
Action ability	Action ability	
Number of options Broadness of issues Broadness of options Broadness of effects	Broadness of analysis, options and effects	
Risk of shift of problem into the future	Shift of the problem	

The temporal scale did not influence the actors involved or the dedication of the actors or their criticalness. However, the people who are involved within an organisation might be very different, as a policy analyst remarked.

A lot of arguments that were mentioned are related to boundary conditions that were present at the start of the policy analysis process or contextual conditions in which the scale choices had to fit at the end of the study. The match of the selected time scale with other issues is considered important:

- Match with planning term of infrastructure
- Match with available other research
- Match with large scale measures
- Match with daily practice
- Match with nature management developments
- Match with other concurrent projects
- Match with other policies
- Match with realisation possibilities of large scale measures
- Match with requested temporal level of aggregation
- Match with spatial scale of options
- Match with term of river basin plans

Similarities and differences in actor perspectives
The variety in criteria that was mentioned by the actor archetypes is large. The similarity to other policies is the only criterion that is considered important by all actor archetypes. Criteria mentioned by two actor archetypes were:

- Inclusion of issues (political actor and commissioner)
- Possibilities to take into account uncertainties (policy analyst and researcher)

All other criteria were mentioned by only one actor archetype.

8.4. Cross-case comparison

Table 8.9 presents an overview of characterstics related to the temporal boundary setting of both case studies.

Table 8.9: Overview the temporal boundary setting in the LTV and the WSS

	Long-Term Vision Scheldt Estuary	Water Shortage Study
Temporal boundaries	2030, but 2005 and 2010 also involved	2015 and 2050 (2005 also involved as reference)
Controversial issue?	Yes	No
Scale choices decision making	Multi-actor oriented. Scale preferences were discussed in a workshop.	Single-actor oriented.
Effects mainly related to	Scientific, political, design and managerial rationality	Mainly the scientific and design rationality

Similarities between the cases
The strategies to reach the objectives in the LTV and the WSS were very similar. In both cases, working on multiple time scales made it possible to create a sense of urgency while at the same time creating a vision on the long term. The combination of short and long term made it possible to include both economic and ecological aspects in the studies. In both cases, it was clear that by using a long-term scale, more uncertainties became involved.

The temporal boundary setting seems to have had little influence on the dedication and the criticalness of the actors involved. For example, in the LTV, no matter what time scale was selected the deepening still remained an issue. Also, in the WSS, no matter what the time scale was the regional actors would be non-dedicated at the start. The different temporal scales mainly had consequences for the types of effects that were studied, the sense of urgency, the types of options found, the overseeing ability, the predictability and the creativity, the action ability and the possibilities of calculating the return on investment.

A lot of similar effects were present in both cases. Examples of factors affected by the temporal boundary setting that were visible in both cases are presented in Table 8.7.

Table 8.7: Similar types of effects of the temporal boundary setting mentioned or/ and observed in the LTV and WSS

Effects	Rationality
Validity of the study Return on investment	Scientific
Sense of urgency Overseeing ability	Political
Action ability Policy relevance Broadness and coherence of analysis, options and effects	Design

Differences between the cases

The starting points in the cases were very different: in the LTV an urgent issue was at stake and the long term had to be incorporated, while in the WSS a long-term issue played a role and a sense of urgency needed to be created.

Another important difference between the LTV and the WSS was the controversy concerning scale choices. In the LTV the selection of the spatial boundaries was regarded as quite controversial because a lot of conflicting political interests were present. In the WSS, competing interests could be recognised instead of conflicting interests. All actors involved wanted the same thing: sufficient water to suit their needs. In the WSS no conflicting preferences regarding the time scale were present because no urgent issues were at stake that actors wanted to solve quickly.

Another large difference between the two cases was the vision about whether to include climate change or not. In the Water Shortage Study, it was thought to be essential to take climate change into account and therefore the term of 2050 was selected, while in the LTV climate change was thought to be too complicating a factor to involve and, therefore, the time scale was limited to 2030. The selection of the time scale also had to do with the fact that the main issue on the WSS agenda was directly influenced by climate change: climate change caused water shortage to occur more frequently and with larger negative consequences. In the LTV, climate change did not play an important role in their agenda's main issue: accessibility. It could even be argued that, if the sea level rises due to climate change, the deepening would need to be less. The involvement of climate change in the LTV case might have caused a shift in focus towards the safety issue which was not considered desirable since the deepening issue was the main reason for the study.

Examples of factors affected by the temporal boundary setting that were visible in only one case are presented in Table 8.8.

Table 8.8: Type of effects of the temporal boundary setting that are only mentioned in one case study

Case study	Effect	Rationality
LTV	Protection of core values Possibilities of consensus building	Political
	Creativity Justifiability	Design
	Effectiveness Efficiency	Managerial
WSS	Content (type of problems, options and effects)	Scientific
	Shiftability of the problem Robustness of options	Design

Table 8.8 shows that the temporal boundary setting in the LTV had more effects related to political and managerial rationalities. The temporal boundary setting in the WSS had more effects related to the scientific rationality, which is not surprising in view of the different overall characters of the cases.

Reflection on the key questions

In order to make a long-term vision when an urgent problem is at stake, the LTV showed it is important to create a sense of urgency by including a short term next to a long term. This was done in the LTV by including 2015 as a backcasting point.

In order to put a long-term problem on a short-term agenda, the WSS showed that it is necessary to make a sound problem analysis to provide clarity on the size of the current problem and the future problem. This can be done by including a scenario study for the long term. The climate change issue and its consequences were getting more and more attention so it was good to put that central because that appealed to people. The water shortage situation in 2003 confirmed that a calamity contributes to getting the issue higher on the agenda.

9. Studying the effects of selection of the level of aggregation

By using a high level of aggregation as a starting point, we secured the progress of the study. A general low level of aggregation would have been a nightmare for the project. It would have sabotaged the entire process. Everyone would have had their hobbyhorses.

-Pers. com. Policy analyst, Long-Term Vision of the Scheldt Estuary, 2004

We could never have made such a complicated model ourselves. The modelling part of this study was one of the reasons for us to get so closely involved in the national study. The national model instrument was clearly something that the Ministry had to offer to the regions…… So, I think it is good that they chose a low level of aggregation.

-Pers.com. Regional political actor, Water Shortage Study, 2005

9.1. Introduction

In this chapter, the effects of the selection of the level of aggregation are studied in the two cases, the Long-Term Vision of the Scheldt Estuary and the Water Shortage Study of the Netherlands. The main goal is to get closer insight into what the effects of the selection of the level of aggregation are in practice.

In the LTV, the spatial level of aggregation appeared to be varying during the entire project, so no clear description of the level of aggregation could be obtained. What is interesting to see is what motivates the analysts to go into more detail. Therefore, situations were discussed in which it was thought important to stay on a higher level of aggregation or go to a lower level of aggregation. The *selection of the spatial level of aggregation* is discussed.

In the WSS, during the extensive modelling studies, many levels of aggregation needed to be selected that were generally low, while the spatial boundaries were broad (the national scale). As discussed in Section 3.8, this could have resulted in a time-consuming study or a challenge to keep the needed time limited. Also, there appeared to be a large difference between the spatial level of aggregation on the observation scale and the spatial level of aggregation on the presentation scale. One of the policy analysts remarked that the level of aggregation on the presentation scale was more than three times higher than the aggregation on the observation scale. Therefore, both are discussed. How this difference arose and how it was handled were both studied.

Key questions:

- *How can the varying requirements concerning the level of aggregation during a study be handled?(LTV)*
- *How can the large differences in the level of aggregation between modelling and presentation be handled? (WSS)*

In the sections that describe the case studies, first the selected level of aggregation was analysed by constructing a system diagram in which the variables taken into account, the exogenous factors, options to be included and the outcomes of interest are diagrammed. Also, an actor analysis diagram was constructed in which the dedication and criticalness of the actors involved is indicated and explained. Next, a thought experiment was conducted in which alternative levels of aggregation are discussed. The alternative levels of aggregation are plausible alternatives that at least one of the actors involved mentioned as an interesting alternative.

The results of the thought experiment are described in two parts: a part presenting the system diagram and the actor analysis diagram for each alternative level of aggregation, and a part in which values are attached to the actors' perspectives. To make the system diagrams and the actor analysis diagrams, the selected level of aggregation is always used as a starting point. The differences between the two diagrams are clearly highlighted.

In the system diagrams of the scale alternatives, changes compared to the original system diagram are shown as follows:

- Additional variables, options and arrows are marked in **bold**
- Variables, options and arrows that do not play a role are marked in grey

In the actor analysis diagrams of the scale alternatives, changes compared to the original actor analysis system diagram are displayed as follows:

- New actors are marked in italics and underlined
- Actors that change positions (dedicated, critical) are marked in italics

The data are based on interviews with the actors involved, and my own observations and analysis. Also, the actors' perspectives on the alternative spatial boundaries are presented; these are solely based on the interviews with the actors involved.

Next, the most important observed effects of the selected spatial boundaries are summarised. These effects were observed by the actors involved and me. To prevent the list of effects from becoming a heterogeneous list of all kinds of effects, a causal diagram was constructed in which tentative causal relations between the effects have been drawn.

The last section of the chapter shows a cross-case comparison in which the results of the two case studies are compared and the similarities and differences are explained. Finally, a reflection is given on the key questions that are presented above.

9.2. Long-Term Vision of the Scheldt Estuary

9.2.1. Analysis of the selected level of aggregation

As a starting point, a high level of aggregation was selected but throughout the study different levels of aggregation were selected for different subjects. Therefore, the actors involved did not think it was possible to reveal any general preferences. As the political actor in favour of deepening remarked:

> *We like to handle the level of aggregation pragmatically and always ask the question: is it worth taking into account or not?*

A very general distinction can be made between a high and a low level of aggregation. In order to be able to reflect on these levels, the two alternatives are therefore compared. Because of the alternate levels of aggregation in the study, it was impossible to construct system diagrams or actor analysis diagrams for them. Additionally, no separate thought experiment was conducted in this case.

High level of aggregation

Arguments to select a high level of aggregation that were regularly mentioned are time efficiency, prevention of conflicts on the details, the possibilities for consensus building and the amount of uncertainty involved.

The field of forces plays an important role in the selection of level of aggregation. A political actor against the deepening noted:

> *The LTV is quite vague on a number of points, but you cannot expect a concrete vision for 2030. I think that the work has been done on a level of aggregation that was feasible. For a low level of aggregation there was no space within the selected field of forces.*

The political sensitivity of the project can be an important reason not to involve unnecessary details in the study. Indirectly, this of course also contributes to consensus building. A commissioner regarded the LTV as a political balancing act to get from polarisation to cooperation. Then, he thought it was important to handle things carefully and not include details that were not important.

According to the policy analysts involved, the information needed to make a decision was the most important factor in the selection of the level of aggregation. A policy analyst stated:

> *We always prefer to work from coarse to fine. Therefore, the vision building took place on quite a high level of aggregation. We always ask ourselves what level of aggregation is needed for the decision making. The research may then, if needed, include more detail than the policy making process. We just do not want needless conflicts to occur over details that are not important for the decision making. That would only delay the process.*

Also, from a strategic point of view, it was good to select a high level of aggregation according to the policy analysts. This contributed in the LTVstudy to the need for cooperation because everyone had to work together to get the complete picture.

The urgency of the problem determined the level of spatial aggregation in the study of options. Solutions for problems that were not considered urgent could be studied globally.

Alternative options for safety were studied using questions like: should space for the rivers be created? Should a surge barrier be constructed? Should the Overscheldt connection be restored?

Even if an issue was considered important, it could be addressed on a high level of aggregation if other more detailed studies were being executed on that issue. If no concurrent research projects existed, it was considered necessary to go into more detail.

An economist stated that the amount of uncertainty also plays a role in the selection of level of aggregation. He mentioned the construction of the economic scenarios as an example. The economic scenarios that were created did not say anything about individual ports but about the entire Hamburg-Le Havre range. It was not possible to go into more detail and make predictions for individual ports on these prognoses because they are very uncertain.

For a complete overview of all the criteria mentioned in favour of and against using a high level of aggregation refer to Appendix 7.

Low level of aggregation

Arguments to go into detail that were frequently mentioned are the urgency of the problem, and the recognisability of the problem for the actors involved. According to the political actors, a more detailed analysis was needed if a certain subject was thought to have a large influence on the problem or was considered important or urgent. Analysis on a low level of aggregation was expected to provide a more precise and reliable answer. One of the political actors remarked that he did not have the ambition to look in detail at operational measures. The level of aggregation that had to be reached was the level that had an influence on the improvement of the estuary. Because, in the beginning of the study, it was considered difficult to determine the factors that influenced the improvement of the estuary, it was also considered important to handle the level of aggregation in a flexible way.

For important and urgent problems, like accessibility, options were studied in greater detail (see also Box 5.2).

The policy analysts also found it helpful to go into more detail to resolve disagreements between the experts. One of them explained this as follows:

> *The Long-Term Vision consists mainly of expert opinions that were well founded by analyses of existing knowledge. Some issues were discussed in somewhat greater detail, for example morphology. The content of the models was discussed, the prediction terms and strategies were calculated. This was needed because between different groups of morphologists different opinions existed on the development of the channel system. The morphologists needed to include a little more detail to be able to cooperate and to reach consensus about joint goals. Possibilities for cooperation and the possibility to formulate joint goals were, for us, important criteria in this matter.*

Some political actors that were involved thought the vision was too vague and wanted their own concrete policy issues to be included. Governmental actors on different levels focused on problems that concerned the area that they were responsible for. One of the policy analysts reflected on that and provided an example:

> *A province wants to know the effects more in detail for their own province and not for the estuary in general. But 'now and here' is not an issue. So, even if you try to think in an*

> *aggregated way some actors involved always want to focus on more details. We tried as much as possible to study the effects on the level of the entire estuary. We succeeded quite well. Some of the effects have to do with user functions. In general for ecology you can look at the entire system. Care was taken not to include policy options that could provide a lot of problems later on, for example block the process. Sometimes however ideas on details come up, like the alternative to restore the Overscheldt, the connection to the Easter Scheldt, that start to live an own life.*

The researchers involved often preferred to work and make models on a lower level of aggregation, to be able to give more accurate answers. Later ,these results were aggregated in order to provide answers that were on a suitable level of aggregation for the decision makers. A policy analyst reflected that in the second phase in the scientific research in which the environmental, economic and technical effects were studied, more details were needed in order to provide answers on a high level of aggregation:

> *I think that an expert can think on an aggregated level when he is familiar with the underlying scientific relations. But this is not always accepted. But for some models always more detailed data is needed, otherwise they give an unrealistic output.*

An ecologist mentioned the available time and data as important criteria for the selection of the level of aggregation, and that these criteria are also related to each other. Use was made of available data because the available time was limited. Therefore, available information at different levels of detail was combined in the study on naturalness. This does not have to be a problem according to one of the ecologists because ecological processes can be described using varying levels of aggregation: at a high level of aggregation biotopes and ecozones are considered, at a lower level of aggregation different variables within those biotopes, like types of macro fauna, are considered. The high level of aggregation, however, resulted in a decrease in the validity of the study according to the researcher. The missing location-specific details caused a lot of uncertainties in the models to predict the effects of the measures on the estuary's ecosystem. A lot of assumptions had to be made in order to predict the effects, causing the validity of the results to decrease. He also linked the level of aggregation to the spatial boundary setting:

> *We can work on all spatial boundaries with all levels of aggregation. The amount of detail depends on the question that is asked. If you ask me to plan an area in such a way that safety and naturalness are optimally combined, then we are going to look into the details like sediment transport velocity, nutrient content, salt-fresh gradient needed, etc. If you ask me what the effects for the Scheldt Estuary are of the water treatment at Brussels, then that question deals with a much larger spatial boundaries. Then, oxygen amounts are modelled, but less detail is used. The problem under study plays an important role in the selection of level of aggregation.*

For morphologists, the level of aggregation is closely related to the temporal boundary involved. Morphologists can look either at a lot of detail in the short term, or very globally in the long term.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 7.

9.2.2. Summarising the effects of the selected level of aggregation

Coherence of issues

The generally high level of aggregation contributed to the coherence of issues.
A commissioner of study noted it this way:

> *With the LTV for the first time the interest of the three subjects is shown and in the solution, coherence has to be created. The high level of aggregation contributed to that.*

The generally high level of aggregation also contributed to keeping the focus on the big picture. One of the policy analysts noted this:

> *A low level of aggregation would not have resulted in an integrated product, because when you go into the details the big picture gets lost.*

One of the morphologists reacted this way:

> *The available time of the project and the political agenda made it impossible to look into details. So the philosophy was: take big steps and you will be home very quickly. A big advantage of a high level of aggregation is that you are being forced to look at the big picture. I think it is very useful to do that. Often, the Ministry of Transport and Water Management cuts a project into pieces and you have to do only a small part of it. So, I think it is good to look at the big picture for a change.*

The occasional low level of aggregation made it possible to recognise the interests of individual actors. A lot of political actors that were involved sometimes thought the vision was too vague and wanted their own concrete policy issues to be included. Individual governmental actors occasionally succeeded in getting problems included that had to do with their own interests.

One of the policy analysts noted:

> *By using a high level of aggregation as a starting point, we secured the progress of the study. A general low level of aggregation would have been a nightmare for the project. It would have sabotaged the entire process. Everyone would have had their hobbyhorses. A low level of aggregation would not have resulted in an integrated product, because when you go into more details the big picture gets lost.*

However, the flexibility in the level of aggregation had a negative impact on its integrated character and coherence. Some policy analysts were not so happy about the integrated character of the study in the end. Because the level of aggregation was flexible, the level of aggregation was adjusted depending on the subject under consideration in the scientific sub-studies. One of the policy analysts noted that the integrated approach to the problems fell apart when the level of aggregation got lower because political actors fall back on their own patterns and start thinking from their own perspectives again, totally ignoring the integrated approach. A policy analyst gave an example:

> *The political interest groups were charmed by the integrated approach, but as soon as the issues were studied in more detail and it became clear that their interests were not quite met, they started to reason from their own perspective again because they thought their point of view was different.*

Also, sometimes details were blown out of proportion. A policy analyst stated:

> *The level of aggregation is very variable. It is difficult to keep the level of aggregation coherent on all the aspects involved. Sometimes an urgent discussion point boils up that needs to be looked upon in detail. When you look back at the report sometimes you think that details are involved that are blown out of proportion. Not important in the main line of argument, but you cannot escape from it because always an interaction exists between content and process. And when the process needs more detail, you have to be able to do that.*

Another reason for the loss of an integrated character was that the researchers started reasoning from their own discipline when details got involved. One of the policy analysts stated the following about this matter:

> *To be able to create a vision, you have to work at a highly abstract level. The first document was directed towards a vision, but one of the demands was that the research had to be done thoroughly; a lot of information was required. So in the next phase, a more detailed technical base was needed for the problems and policy options. Technical specialists were hired that were working in a single discipline, so the link with the other aspects disappeared. Although these specialists realised that they needed to work with other disciplines to make an integrated vision, this turned out to be difficult. The file became a collection of separate files and therefore during the progress of the project the coherence was a bit lost and integrating it in the end also appeared to be difficult. Therefore, I think the idea of an integrated vision was not entirely realised. I see the necessity for practical reasons that the project be cut into different pieces and to go sometimes into detail, but then it is important that at the end the pieces are brought together again and the information is aggregated. Often, this is not done well.*

The on-going process of selecting a level of aggregation occasionally led to some communication problems on the limits of the detail that could be provided, for example between the morphology and ecologists. According to one of the morphologists, the perception of the ecologists of what information the former researchers could deliver was too optimistic, while on the other hand the morphologists seemed to think that the ecologists did not know exactly what they wanted to know. Ecologists were inclined to ask information about all the possible details on the square centimetre, while the morphologists felt they were unable to provide that information. When reflecting, one of the ecologists recognised the difference in level of aggregation present between morphology and ecology: morphologists can either look at a lot of detail in the short term or very little detail in the long term. The ecologists, however, feel that they are just in the middle: not predicting very far into the future and not including a lot of details.

Prevention of conflicts over the details

The high level of aggregation often contributed to the prevention of conflicts over the details, according to a lot of actors. It was, however, not the intention of the policy analysts to prevent conflicts. A policy analyst noted that they wanted to mark conflict points and point out later that they were agreed upon so no one could come back to these issues later in the process. In order to prevent conflicts, a political actor thought that it was important to make sure that the agreements on a low level of aggregation were not contrary to the agreements on a higher level. Many actors considered it important to avoid conflicts over needless details as much as possible because this would delay the desired fast process. Sometimes, when conflicts were present, a rise in the level of aggregation could be noticed. A political actor against the deepening said:

> *If I look at the text of the LTV nothing else could have resulted than what is there at the moment. It was a tension field: I attended meetings in which to my dismay we went through*

> *the text page by page at a rate of two pages in two hours because the proposals of the different sides were very contradictory. The writer of the texts had to come up with a proposal with which both sides would agree. What you could see happening was that the level of aggregation was raised in these situations: more abstract texts were the result. To raise the level of aggregation was in my opinion a standard solution to avoiding conflicts.*

One of the policy analysts noted:

> *By using a high level of aggregation as a starting point we secured the progress of the study. A general low level of aggregation would have been a nightmare for the project. It would have sabotaged the entire process. Everyone would have had their hobbyhorses.*

The general high level of aggregation contributed to achieving the objectives of the study within the allotted time and budget. The high level of aggregation contributed to excluding the regional issues and the regional actors that would have made it even harder to reach consensus. Also, the high level of aggregation made it possible to avoid too many conflicting details to enter the discussion that would contribute to consensus building.
One of the policy analysts reflected:

> *The LTV provided a framework and that was the intention. A fairly high level of aggregation was selected and some people described the LTV report as too woolly and vague. I think it was a first document from which follow-up actions were taken and it should be judged in this way. I am happy with it.*

The downside was that the high level of aggregation also caused a lack of clarity because it did not always provide a sufficient base to make choices upon, according to one of the policy analysts.

Limited regional support
The selected high level of aggregation contributed to the exclusion of regional and local actors (for example municipalities and local organisations). This was done on purpose because, otherwise, many additional actors would have had to have been involved in the study. One of the policy analysts stated this about that:

> *I think that the choices on actor involvement were exceptionally bad in this study. This should be seen as a separate choice and not automatically following from the level of aggregation and the spatial boundaries. Now it followed directly from the level of aggregation. At the end of the study, it appeared that there was little regional and local support for the results of the study.*

The high level of aggregation resulted in the exclusion of regional issues because it limited the involvement of regional and local actors. For example, little attention was paid to recreation, an issue that is often raised by regional and local actors. A political actor said:

> *I think it would have been interesting to involve the sectors, like agriculture and recreation, more closely in the study. This also has to do with the level of aggregation because the political levels on which decisions about these sectors can be made involve also regional and even municipal governments.*

The downside is that many regional and local actors who felt that they had to be consulted were excluded from the study and did not support the results of the study at all.

Figure 9.1 summarises the effects of the selected level of aggregation in a causal diagram. Again, it is emphasised that the relations are plausible but tentative. As can be seen in the diagram, the combination of a high and low level of aggregation sometimes turned out to be an advantage (prevention of conflicts over details by a high level of aggregation and recognition of interests of individual actors). Sometimes, however, the combinations turned out negatively. For example, a high level of aggregation contributed to the coherence of issues while the involvement of details led to the partial loss of the coherent and integrated character.

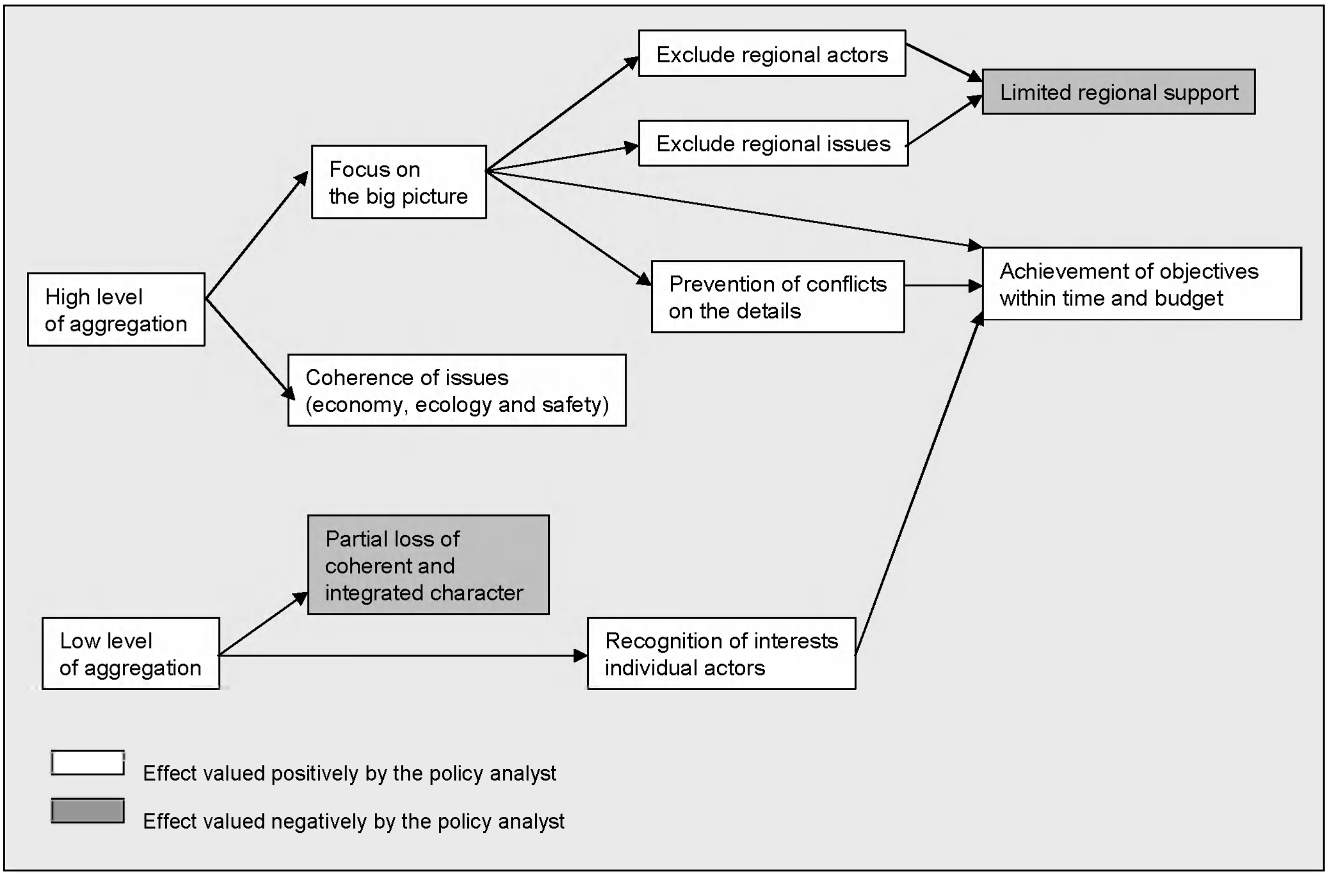


Figure 9.1: Causal diagram of effects of the selection of the level of aggregation in the LTV

9.2.3. Concluding remarks

Contribution of the level of aggregation to the achievement of objectives of the study
The generally high level of aggregation in the project contributed to consensus building in the project. It was important to build a good foundation of trust between the parties by creating a rather aggregated joint vision. In general, it could be concluded that the discussion about the details was postponed until the next phase.

Effects of the level of aggregation
Table 9.1 presents the observed and mentioned effects of the selection of level of aggregation in the LTV.

Table 9.1: Overview of the types of effects of the level of aggregation in the LTV

Effect	Clustered effect	Related rationality
Scientific validity Match with large influence on the problem Handling dispute of knowledge in the team of experts	Scientific validity	Scientific
Inclusion of issues Inclusion of effects	Content (problems, options and effects)	
Recognition of interests	Recognition of interests	Political
Prevention of conflicts	Prevention of conflicts	
Possibilities of consensus building	Possibilities of consensus building	
Exclusion of actors Involvement of actors	Openness	
Recognisability (own concrete policy issues)	Recognisability	
Support for the study	Support	
Coherence of issues	Coherence and broadness of issues, options and effects	Design
Integrated character	Integrated character	
Visibility of the big picture	Insight in big picture	
Need for cooperation	Need for cooperation	
Fit with vision building Achievement of objectives	Effectiveness	Managerial
Time efficiency Finishing within time and budget	Efficiency	

Although many arguments relate to the effects of the scale choices, some of them are related to boundary conditions that existed at the start of the policy analysis process or to contextual conditions in which the scale choices had to fit at the end of the study. The match of the selected level of aggregation with some other issues is considered important::

- Match with high political sensitivity
- Match with presence of concurrent projects
- Match with availability of data

Similarities and differences across actors' perspectives

All actors mentioned time efficiency as an important criterion. The following criteria were mentioned by two actor archetypes:

- Availability of data (policy analyst and researcher)
- Recognisability (political actor and policy analyst)

9.3. Water Shortage Study: modelling

9.3.1. Analysis of the selected level of aggregation

Generally, a low level of aggregation was used for the modelling (such as for the hydrological modelling). Occasionally, a differentiated level of aggregation was used for the different disciplines involved, like agriculture and ecology.

Low level of aggregation (grid resolution of 500 x 500 metres or even 25 x 25 metres)
The problem of water shortage was very different in the different regions. Due to the problem's heterogeneity, it needed to be assessed in detail and no generic system diagram could be constructed. The regional political actors were in favour of a maximum resolution of the modelling because regional interest was mainly based on the models which were difficult for them to construct because specialized knowledge was needed. A high resolution also made it possible for them to judge the reliability of the models.

By the selection of a low level of aggregation, all actors involved were dedicated to the problem.

Table 9.2: Actor analysis diagram of the low level of aggregation, WSS modelling

	Critical actor	Non-critical actor
Dedicated actor	Ministry of Transport and Water Management Water boards	RIZA Ministry of Nature and Agriculture EnergieNed IPO VNG LTO VEWIN
Non-dedicated actor	-	-

Actor perspectives
The national political actors recognised that, to define policy options, it was necessary to take into account what the needed level of aggregation was. It was considered difficult to convince people of the need for large or expensive projects in which it was not possible to relate the water shortage issue to other urgent issues or in which measures for water shortage could be combined to solve other problems to create win-win solutions. A low level of aggregation and high reliability of the expected results were needed to be able to convince people of the benefits. The reliability was called 'doubtful' by one of the policy analysts. A low level of aggregation might also have given an unwarranted feeling of security. A policy analyst remarked that it was important in cases of such complex modelling activities that a commissioner judges the value of the results. Based on the low level of aggregation, one might falsely assume that the results are reliable. One of the hydrologists agreed and stated that more detail in the modelling led to more trust in the modelling instruments, though that was not always true.

One of the hydrologists would have liked to have gone into even more detail but recognised that the technological possibilities were a limiting factor. He stated:

> *The smallest modelling unit in our model was 500 by 500 metres. Originally, I preferred to work in even more detail, for example 250 by 250 metres. If you consider that some data, like groundwater levels, land use and ground levels, are available on 25 by 25 metres, you can imagine that we had to scale-up a lot of data. I think it would be beneficial for the output quality of the model to be able to calculate on a level of aggregation that is as low as possible depending, of course, on data availability. The calculation time of the models was very high at that time, sometimes it took us a few days for a run. Therefore, it was not possible to make a model on a lower level of aggregation. We spent a lot of energy in scaling-up the variables carefully, so that the variables were representative for the entire area. If I had to do the whole modelling activity again with the fast computers that we have available now, I would have*

taken 25 by 25 metres as a modelling unit. Especially for the optimisatio,n it is necessary to look into more detail, because the fine tuning has to be very accurate.

The ecologists agreed with the desired lower level of aggregation. One of them stated:

I see a model mainly as a supportive tool in the communication. For the ecological model I would have liked to make a model with a resolution of 25 by 25 metres. Reasons are the transparency; the possibilities for validation and the recognisability which makes it better discussable with experts.

On the other hand, another researcher sees the downside of the low level of aggregation:

Because of the low level of aggregation it was only possible to work with indicator years, like for example 1976. The disadvantage is that such an indicator year is influenced by many variables such as for example the precipitation in the winter, the moment the water shortage occurred etc. I would have preferred to work with a range of years to decrease the influence of these coincidences. This is however not possible because of the large calculation times of the modelling instrument that are related to the low level of aggregation: it takes one day to calculate one year.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 7.

Differentiated level of aggregation
The national political actors mentioned as a disadvantage the different levels of aggregation that it made it more difficult to conclude whether a correct assessment of the problem had been made. The policy analysts were in favour of a pragmatic level of aggregation: a detailed problem analysis on topics for which policy options could be designed, and less detailed if it was considered impossible to do anything about. According to the policy analysts, a lot of energy had been put into the modelling efforts on topics that were not interesting, from his point of view. On the other hand, the policy analysts also saw the unbalanced appearance of a differentiated level of aggregation as a big disadvantage. A policy analyst said:

If a low level of aggregation is used, this might imply that that counts for everything. If that information is not available, then it may appear unbalanced and lead to questions.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 7.

9.3.2. Thought experiment

Because the selected alternatives cover the low level of aggregation in the thought experiment, only one alternative is discussed here: a high level of aggregation. This alternative was preferred by some policy analysts and some researchers who thought it important to understand the processes.

High level of aggregation (tens of kilometres x tens of kilometres)

System diagram
When using a high level of aggregation, it becomes possible to create a process model of all important processes playing a role. A system diagram was constructed (Figure 9.2) and shows

both national and regional processes. This system diagram might provide a basis for a process model that can be constructed at a high level of aggregation.

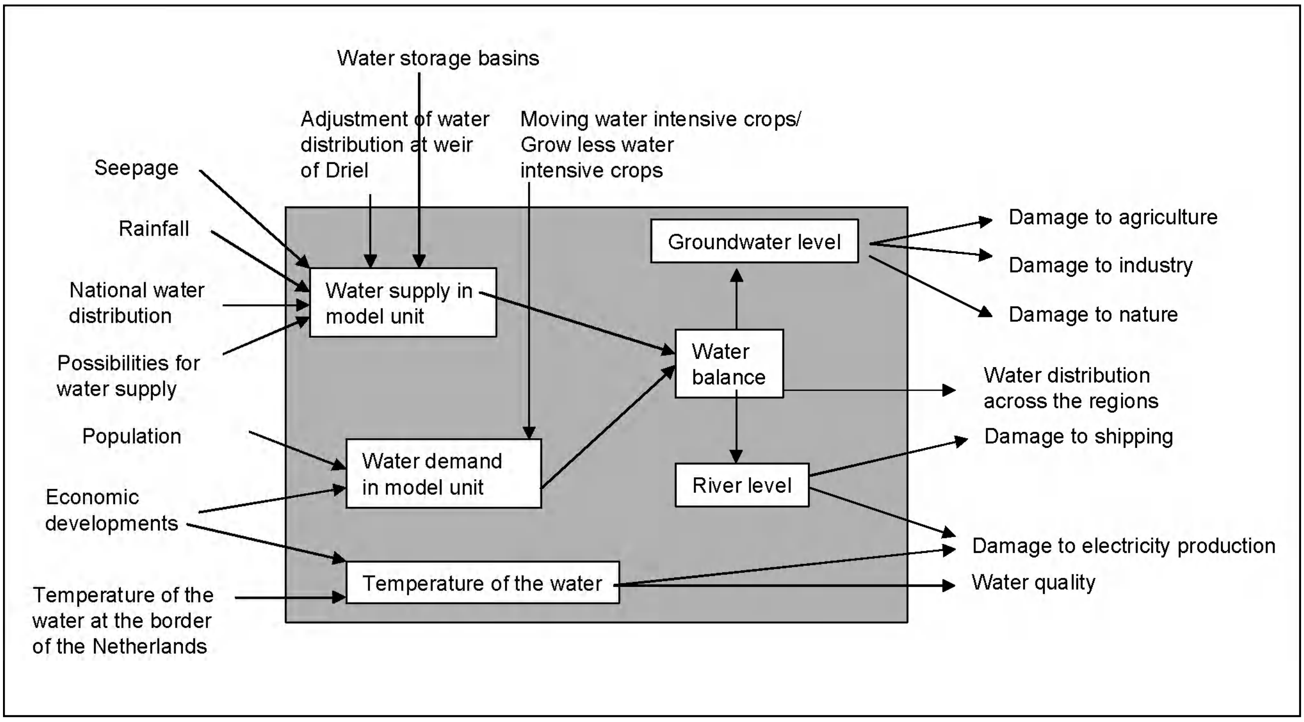


Figure 9.2: System diagram presenting the main processes playing a role in a modelling unit

Actor analysis

The actor analysis diagram shows a different picture than the actor analysis diagram for the low level of aggregation. The regional actors became non-dedicated when using this level of aggregation because recognisability for them was limited.

Table 9.3: Actor analysis diagram of the high level of aggregation, WSS modelling

	Critical actor	**Non-critical actor**
Dedicated actor	Ministry of Transport and Water Management	RIZA Ministry of Nature and Agriculture
Non-dedicated actor	Water boards	EnergieNed IPO VNG LTO VEWIN

Actor perspectives

At a high level of aggregation, it would have been better, possibly, to gain insight into the important parameters and processes that played a role. One of the hydrologists mentioned flexibility as an advantage of a high level of aggregation of the models. If adjustments would have to be made or alternatives would have to be studied, it would be easy to adjust the models quickly. Also, some policy analysts, a hydrologist and a national political actor felt that a high level of aggregation would fit better with the large uncertainties involved. One of the national political actors remarked:

> *For the process I think it would have been important to start working at a high level of aggregation and later go into the details where needed to reach a sound decision. Working from coarse to fine provides balance and a good understanding of the processes and parameters playing an important role.*

No models were available at a high level of aggregation; this meant that new models had to be made, which was considered a disadvantage by many of the actors involved. Also, it would be more difficult to judge the reliability of the results because mistakes might fade out. The regional political actors thought that high level aggregation models were not relevant for them at all.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 7.

9.3.3. Summarising the effects of the selected level of aggregation

The low level of aggregation in the modelling made an enormous contribution to the regional actors' commitment because it was, for many of them, an important motivation to get involved. One of these actors explained:

> *We could never have made such a complicated model ourselves. The modelling part of this study was one of the reasons for us to get so closely involved in the national study. The national model instrument was clearly something that the Ministry had to offer to the regions. The regions were not capable of making such a large model on their own. So, I think it is good that they chose a low level of aggregation. I can also see that in the study we did in the Centre-West Netherlands. It was for many participants attractive to join in because they could easily obtain the information about the modelling. We use the results extensively in our regional study. I think the low level of aggregation in the modelling was an important way to get the regional actors involved in the process and was a motivation for them to go to the Water Shortage Days.*

Models with a low level of aggregation appear to be trustworthy. However, the detailed models gave an unwarranted feeling of reliability. Especially the people in the regions relied on the detailed models to be true, while their reliability was sometimes limited. The available models that had to be used as a starting point could not all operate on such a low level of aggregation. This made it very difficult to reach reliable results. One of the policy analysts remarked:

> *It was strange for us to experience that although the modelling results were available on such a low level of aggregation, statements about aggregated areas of for example a hundred square kilometres were often not allowed because they were thought to be too unreliable.*

The unwarranted feeling of security in the modelling was expanded by a number of factors. Detailed field expert knowledge was often not as reliable as was thought. According to a researcher and a regional political actor, this false sense of confidence between researchers and regional field experts appeared to be mutual. Just as field experts rely on the models to be true, researchers believe that the water boards have detailed knowledge of their area (expert knowledge) and therefore are able to judge the results of the models. However, in some areas the knowledge is very fragmented so it is not possible to know what actually happens. Also, it is possible that farmers, for example, let water in their area without the water board knowing. This has two consequences: first, the data that is received by the field experts as input data for the model may often not be as reliable as the researchers think. Second, when the modelling results are checked by the regional experts they may not disagree with the outcome but that does not always means that the results of the models are correct.

According to several actors, the feeling about the big picture got lost because of the low level of aggregation. During the interview, one of the hydrologists called the model that was constructed ‘a black box’: there was too little insight into the processes underlying the model. This made it difficult to assess what parameters were important and how they influenced water shortage. According to him, the level of aggregation in the presentation was increased when the amount of uncertainties increased. As a consequence, it was unclear how reliable the model was. To be able to know what actually happened, the model should have been calibrated by taking a few small areas to look at what was really going on there.

The amount of detail used in the modelling and the large number of models made it difficult to assess the effects of measures quickly, and this was one of the causes for the delay in the project. The modelling study became a huge endeavour. It took a long time to run the models’ calculations. In the beginning of the study, the computing time for one calculation including preparation was a few days. Another important factor that played a role in the delay was the water shortage situation in the summer of 2003. An advantage was that this event also provided the modellers with an extra set of data to calibrate the model which increased the models’ reliability.

The intention of the differentiated level of aggregation was very good: a detailed problem analysis on topics that were important and for which policy options could be designed, and less detailed if the problem were less important or where no options were feasible. However, in the end, the differentiation appeared to be mainly based on data availability. One of the ecologists commented:

> *Little investment has been made in solving the knowledge gap. The data availability played the determining role. Sometimes, however, it might be good to invest in getting the data you really want in order to make a new innovative model.*

One of the national political actors also did not agree with the reason that was presented to select a differentiated level of aggregation in the study:

> *The differentiated level of aggregation was mainly caused by the difference in data availability. I am in favour of a differentiated level of aggregation but I think it is important to let the depth of information depend on the interest at decision time. The evaluation framework can be used to make explicit which knowledge is needed in the decision-making process. The focus can then be put on gaining this particular knowledge.*

Unbalanced attention to issues led to a lack in clarity for the problem. Although during the project it was noted a number of times that the questions on the process track would be leading, data availability ended up playing an important role in the selection of the level of aggregation, especially in the modelling part in the first phase. One of the national political actors commented that this led to an unbalanced attention to issues that were already known (like effects on agriculture) while unknown issues, like saltwater intrusions and the effects on ecology, were less well addressed. Also, difficult issues seemed to get less attention than less difficult issues. This was camouflaged by giving a lot of attention to other issues. Different sectors have been modeled on different levels of aggregation. One of the political actors involved thought it was therefore questionable whether the real problem was clear.

One of the policy analysts said:

> *In the problem definition phase there has been too much attention on the details in the modelling instrument. Looking back we could have formulated the results without the models. Despite that fact I think the models do have an important function for the discussion because you need the exact numbers.*

Figure 9.3 summarises the effects of the selected level of aggregation in the modelling in a causal diagram. Again, it is emphasised that the relationships are tentative and plausible.

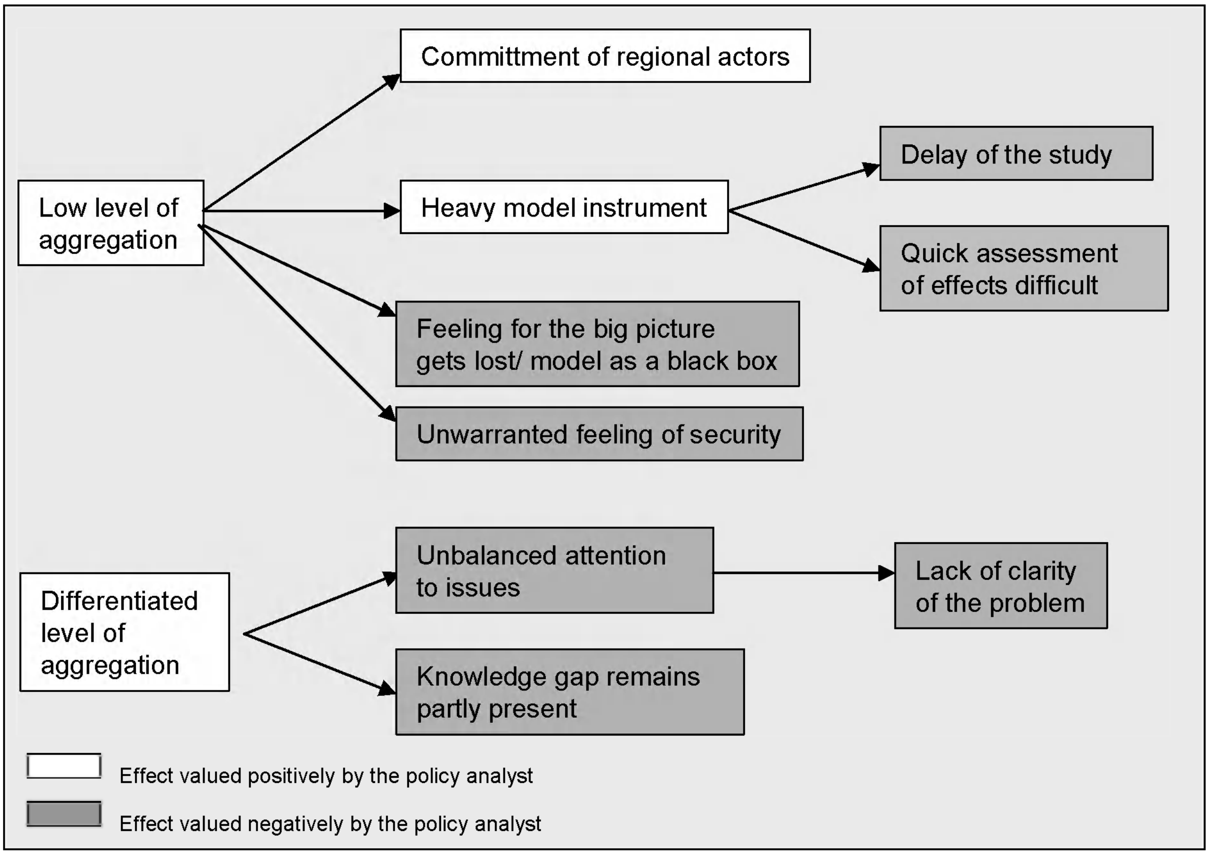


Figure 9.3: Causal diagram of effects of selection of level of aggregation in the modelling in the WSS

9.3.4. Concluding remarks

Contribution of the level of aggregation to the achievement of objectives of the study
In the modelling of the Water Shortage Study, different goals related to different levels of aggregation were present that were difficult to unite. The choice to carry out the modelling in great detail caused a delay in the project but this was not considered a big problem. On the other hand, the low level of aggregation contributed to creating a commitment from the regional actors. Although at first the regional actors were less interested in the study because of the selection of the national spatial boundaries, they became more interested due to the selection of the low level of aggregation in the modelling. This provided them with interesting and usable models they could not have constructed themselves. Therefore, the low level of aggregation is considered to have contributed to the achievement of objectives of the study because it helped to get the regional actors involved and therefore also to place the issue of

water shortage on the agenda. Also, it helped to assess the size of the problem and to assess the effects of the measures and, therefore, the *design and recommend* role of the study.

Effects of the level of aggregation

Table 9.4 shows an overview of the effects of the selection of the level of aggregation and the related perspective. This table shows that the selection of the level of aggregation in the modelling in the WSS had effects on the research, process, project and design characteristics.

Table 9.4: Overview of the types of effects of the selection of the level of aggregation in the WSS modelling

Effect	Clustered effect	Related rationality
Validation possibilities Reliability Possibility to judge the reliability of the results Feeling of security	Scientific validity	Scientific
Match with interestingness of issues Interestingness	Interestingness	
Clarity of the problem	Clarity of the problem	
Communication possibilities	Communication possibilities	Political
Commitment of regional actors	Commitment of actors involved	
Transparency	Transparency	
Possibility to put on agenda	Agenda possibilities	
Usability Match with solvability of the problem	Action ability	Design
Balance in attention	Balance in attention	
Flexibility	Flexibility	
Insight into big picture	Insight into big picture	
Finishing on time	Efficiency	Managerial

Although a lot of arguments have a relation to the effects of the scale choices, some of the arguments were related to boundary conditions that were present at the start of the policy analysis process or contextual conditions in which the scale choices had to fit at the end of the study. The match of the selected level of aggregation with some other issues is considered important:

- Match with limited attention
- Match with presence of concurrent projects
- Match with expensive measures
- Match with availability of data

Similarities and differences in actors' perspectives

The variety in criteria that was mentioned is very high. No similarities can be noted.

9.4. Water Shortage Study: presentation of the results

9.4.1. Analysis of the selected level of aggregation

In different situations, different alternatives for the level of aggregation were selected to present the results. The used alternatives were:

- High level of aggregation: division in European Framework Water Directive (WFD) regions (the Netherlands divided into 7 regions) or a division in Water Management 21 Century (WB21) regions (the Netherlands divided into 17 regions)
- Low level of aggregation: division into districts (130)

The WFD regions, the WB21 regions and the division into districts were all incorporated in the level of aggregation for the presentation of the results. The water shortage situation was presented on a low level of aggregation (district level) while the options were presented on a high level of aggregation (WB21 regions).

No system diagrams were constructed because the presentation of results was made at the end of the study and, therefore, did not influence the system that was studied.

The actor analysis diagram has been adjusted somewhat: only the dedication of actors is being presented. The criticalness of actors did not play a role in the presentation of results, therefore only a distinction has been made between dedicated and non-dedicated actors. The dedication of the actors is thought to be influenced by the level of aggregation of the end results. Their dedication is considered relevant because the study is considered to be the first step in a process on water shortage: the regions have to conduct regional water shortage studies.

WFD regions

Figure 9.4: Division into 7 WFD regions

The European Framework Directive Water emphasises the importance of the international river basins and puts these central in defining the WFD regions: the rivers form the axis of the regions (Bosma and Busch, 2002).

Actor analysis
The regional actors would not feel dedicated when using such a high level of aggregation in the presentation of the results because of the limited recognisability. Table 9.5 shows the adjusted actor analysis diagram on the WFD regions.

Table 9.5: Actor analysis diagram of the WFD regions, WSS presentation

Dedicated actor	Ministry of Transport and Water Management RIZA Ministry of Nature and Agriculture EnergieNed
Non-dedicated actor	Water boards IPO VNG LTO VEWIN

Actor perspectives
Actors had very different opinions about this alternative. This alternative was preferred by the national political actors working on the European Framework Directive Water. The main reasons were the presentability, the comparability of problems and the possibility of attributing water shortage for shipping to a region. The national political actors mentioned a number of reasons they were in favour of this alternative. They thought it was closer to the government's responsibilities. Also, for a national study, only the big picture was considered important. The researchers mentioned a practical reason in favour of the WFD regions: they had to be able to express the problem of water shortage in the river basin plans, so it would be good to select a similar division in the regions.

An ecologist and a hydrologist thought that the presence of different subdivisions regarding WFD and WB21 caused a lot of confusion. An ecologist commented:

> *I think we have to get rid of that. It is not good that only in the Netherlands do different kinds of divisions exist. For the WFD regions, a very clear argumentation can be provided. Also we have to be able to make the river basin plans; they are going to play an important role in the near future. Everything needs to fit in there so I think it is necessary to start working on that level of aggregation.*

Also regarding the layout, the WFD regions offered advantages. A hydrologist responded:

> *From the perspective of the layout it would be better to present the results in the WFD regions than in the WB21 regions because the tables in WFD regions become smaller. It is then possible to present two tables on one page with some explanatory text underneath them.*

The regional political actors mentioned many arguments against the WFD regions. They thought that the recognition of the areas was difficult because it was considered too abstract. Also, the water boards could not draw any conclusions about whether they should take action or not. Another issue was that the content of the conclusions was an important reason not to use the WFD regions because the problems in the main waters were not as large as the problem in the regions. Agriculture was considered to be the biggest problem, so there was no need to focus on the rivers. One of the regional actors thought that increasing the level of aggregation could also be used to prevent criticism from the water boards, but he stressed that it must be realised that it does not make the mistakes disappear, it only hides them:

> *Sometimes you can see that it is a deliberate choice to scale the results up because otherwise they expect criticism from the water boards that some results are wrong. Presenting results on a higher level of aggregation is an easy way to prevent criticism from water boards but they do not seem to realise that mistakes do not have to disappear if you present the results on a higher level of aggregation. This counts both for the WFD regions and the WB21 regions.*

A hydrologist also saw some disadvantages related to the WFD regions. He thought that on a WFD scale, results get much too polished because it does not give good insight into where the problems are located in reality.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 7.

WB21 regions

Figure 9.5: Division into 17 WB21 regions

The WB21 focuses on the regional waters and uses the national waters (rivers) as boundaries of the regions. For efficiency reasons the choice is made to let the boundaries of the partial river basins coincide with the boundaries of the current water boards (Bosma and Busch, 2002).
So, although the level of aggregation in the WB21 regions and the WFD regions may appear rather similar at first sight, the principle behind the division is very different. In the WB21 regions, the rivers are the boundary, and in the WFD regions the rivers are the central axis.

Actor analysis
This actor analysis diagram is almost the same as the previous one. Only one difference can be noted: the water boards have become a dedicated actor because the division in regions is much more similar to their level of authority than in the WFD regions. Table 9.6 shows an overview of the results of the actor analysis on the WB21 regions. Only the dedicatedness is presented because criticalness does not play a role in the presentation.

Table 9.6: Actor analysis diagram of the WB21 regions, WSS presentation

Dedicated actor	Ministry of Transport and Water Management Ministry of Nature and Agriculture Water boards RIZA EnergieNed
Non-dedicated actor	IPO VNG LTO VEWIN

Actor perspectives

This alternative was preferred by the political actors working on water shortage. One of the national political actors involved argued that policy makers do not want too much detailed information and thought that the presentation had to be appealing and effective. Therefore, the presentation on the level of the WB21 regions would be a good option. A political actor at the regional scale agreed but mentioned a different reason:

> *By selecting the WB21 regions it becomes visible that water shortage is a problem that plays throughout the country. It also shows that it is not possible to solve the water shortage problem by dividing it differently across the country.*

A policy analyst regarded the multipurpose functionality of the WB21 regions as a large advantage. If the information were presented according to the WB21 regions, it would always be possible to aggregate to the WFD regions. In that way, it would be possible to answer any question. Also, the Water Shortage Study was a study related to water quantity and not to water quality, and it performed under the flag of the WB21, so a good match with WB21 was more important than a match with the WFD that is more water quality oriented. According to the researchers, the models were reliable enough at this level of aggregation.

The regional political actors were a little more enthusiastic about this alternative than about the WFD regions. They thought the division into WB21 regions matched better with other policies and that water boards could see a little bit whether they had a bigger problem than the others. Also, the regional political actors mentioned similar arguments against this alternative as against the WFD regions: mistakes do not have to disappear if you present them at a higher level of aggregation and the water boards cannot draw any conclusions on whether they should take action. The ecologists thought that the argumentation for the WB21 regions was completely lacking and therefore should not be used. Other arguments against the WB21 regions that were mentioned are the political sensitivity and the focus on regional differences.

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 7.

Districts

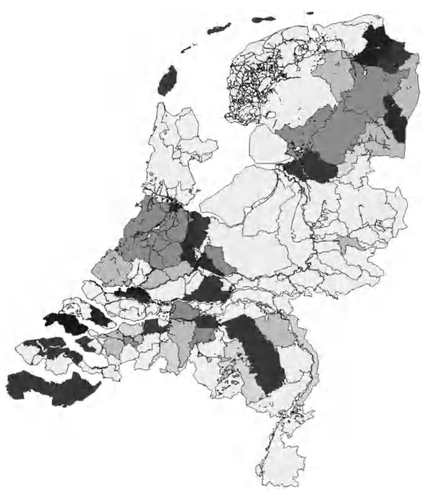


Figure 9.6: Division into 130 districts

In the PAWN study, the Netherlands was divided into 85 districts. In these units the hydrological characteristics were similar. Before the Water Shortage Study was started, a survey was made about whether the districts were still a usable distinction. Interviews were held with the water boards to discuss the districts. This survey led to an adjustment of the district boundaries and the number of districts, resulting in 130 districts.

Actor analysis

By using this low level of aggregation, the results would become more recognisable to and usable by the regional actors. Also, the regional actors would be better able to judge the reliability of the results. So, it was expected that the dedication would increase because they could actually act upon the results of the study. Table 9.7 shows the actor analysis diagram for the districts.

Table 9.7: Actor analysis diagram of the districts, WSS presentation

Dedicated actor	Ministry of Transport and Water Management Ministry of Nature and Agriculture Water boards RIZA EnergieNed IPO VNG LTO VEWIN
Non-dedicated actor	-

Actor perspectives

Regional political actors wanted to know what the effects of water shortage were for their region or sector. They also wanted to know what the consequences of solutions would be in their region. Therefore, they required more detail (de Groen, 2003). More details also made it easier to judge the quality of the results. The division into districts was determined in cooperation with the water boards and therefore had support from the regions. This was also the level at which measures had to be defined, according to the regional actors.

Some national political actors and some commissioners of the study were not familiar at all with the district option. They did not think it played any role and were surprised that it was used in the presentation of the water shortage situation. Especially the national political actors mention a lot of arguments against this alternative. They thought it was too detailed and that nothing could be done politically with such a detailed picture on a national level. Another national political actor said he was not interested because he did not have influence at that level. A national political actor responded:

> *I do not consider it very important that the water boards find it interesting to involve these details. If the water boards want to have more detailed information of their own region, they can always go to RIZA and ask.*

A hydrologist thought that it was good to select the district options because it had a basis in the hydrological modelling units. Also, it was good because mistakes become visible when zooming in at this level. On the other hand, another hydrologist did not regard the reliability of the models good enough to present the information at the district level. He commented:

> *I did not want to use such a low level of aggregation because the models are not reliable enough. The models are reliable enough to present the results for the WB21 regions. If the models would have been more reliable I would have liked to present the results on a low level of aggregation. I can even imagine that the water boards want even more details to be involved in the presentation, for example the Local Surface Waters containing 2000 units or even the modelling units containing pixels of 500 by 500 metres*

For a complete overview of all the criteria mentioned in favour of and against this alternative, refer to Appendix 7.

9.4.2. Summarising the effects of the selected level of aggregation

Multiple levels of aggregation were selected in the presentation of the results: the water shortage situation was presented on a low level of aggregation (district level) while the options were presented on a high level of aggregation (WB21 regions). The selection of the level of aggregation of the presentation scale was made at the end of the policy analysis process, so it had no influence on the content of the study. It only emphasises different aspects and makes details visible or not.

The multiple levels of aggregation in the presentation of the results contributed to recognisability for the national and the regional actors involved, which is also shown by the causal diagram in Figure 9.7. Multiple levels of aggregation also contributed to the usability and action ability of the different actors involved. Presentation of the water shortage situation in 130 districts contributed to action ability/ usability by the regional actors. At the relatively high level of aggregation (WB21 regions), the regional options were, however, not visible.

Figure 9.7 summarises the effects of the selected level of aggregation in the presentation in a causal diagram. Again, it is stressed that the relationships are tentative and plausible.

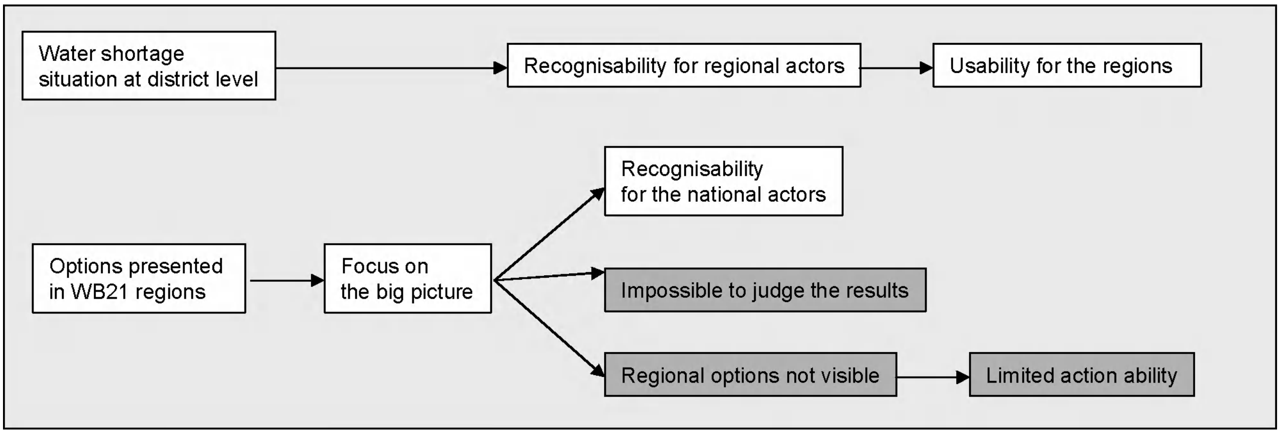


Figure 9.7: Causal diagram of effects of selection of level of aggregation in the presentation in the WSS

9.4.3. Concluding remarks

Contribution of the level of aggregation to the achievement of objectives of the study
The multiple levels of aggregation in the presentation of the results did justice to the different objectives and therefore contributed to the success of the study. It created commitment with both the regional actors and the national actors by making it possible to involve the local details that were interesting for the regional actors without compromising the national goals.

Effects of the level of aggregation
Table 9.10 shows an overview of the observed and mentioned effects of the selection of the level of aggregation in the presentation of the results and the related perspective. This table shows that the selection of the level of aggregation in the WSS had effects on the research, process, project and design characteristics.

Table 9.10: Overview of the types of effects of the selection of the level of aggregation in the WSS presentation

Effect	Clustered effect	Related rationality
Match with system under study Insight into complexity problem Validation possibilities Clear modelling unit Match with hydrological base Mistakes only become visible when starting to zoom in Possibilities to check results Attribution of problems to an area Possibilities to present reliable results Reliability of the model presentation Uniformity of problems within units	Scientific validity	Scientific
Interestingness	Interestingness	Scientific
Sovereignty of regions	Protection of core values	Political
Political sensitivity	Political sensitivity	Political
Overseeing ability for the regions Recognisability (of the problem) Visibility of regional options	Recognisability	Political

Recognition of the areas		
Commitment of regional actors	Commitment	Political
Support	Support	Political
Relevance Match with the political agenda Match with political interest	Policy relevance	Design
Usability Action ability Multifunctional usability	Action ability	Design
Ability to distinguish	Ability to distinguish	Design
Appeal	Appeal	Design
Prevention of criticism Justifiability	Justifiability	Design
Effectiveness Match with intended focus of discussion Contribution to success of the study	Effectiveness	Managerial
Match with level of authority Match with governmental responsibilities	Match with level of authority	Managerial

Although many arguments related to the effects of the scale choices, some of the arguments were related to the boundary conditions that were present at the start of the policy analysis process or contextual conditions in which the scale choices had to fit at the end of the study. The match of the selected level of aggregation with some other issues is considered important:

- Match with WB21
- Good to match with other policies
- Match with PAWN results

Similarities and differences in actor perspectives

Many criteria were mentioned. All actor archetypes mentioned the recognisability and the match with other plans and policies (river basin plans and WB21) as important arguments. A criterion that was mentioned by two actor archetypes was usability (researcher and political actor).

9.5. Cross-case comparison

Table 9.11 provides an overview of the characteristics related to the level of aggregation of the case studies.

Table 9.11: Overview of the selection of the level of aggregation in the LTV and the WSS

	Long-Term Vision Scheldt Estuary	**Water Shortage Study, Modelling**	**Water Shortage Study, Presentation of results**
Level of aggregation	Generally high, but varying based on available information	In the modelling studies, a general low level of aggregation was selected, although it became a little differentiated because of the difference in data availability	High (WFD and WB21) for options, Low for water shortage situation
Controversial issue?	No	A bit, it generated quite a lot of discussion because different preferences were present	Yes, even similar levels of aggregation (WB21 and WFD) led to intense discussions because use was made of different starting points
Scale choices decision making	Multi-actor oriented during the entire process	Multi-actor oriented	Multi-actor oriented
Effects mainly related to	Scientific, political, design and managerial rationality	Mainly scientific, political and design rationality	Scientific, political, design and managerial rationality

Similarities between the cases

In the selection of the level of aggregation, it was not always possible to present a system diagram and an actor analysis diagram because of the fluctuating levels of aggregation during the study and the fact that, for one subject, a more detailed analysis could be made than for another.

Important common effects of the selection of the level of aggregation that can be seen in the cases are related to actor involvement, recognisability and the commitment of actors. A low level of aggregation helped to create commitment of regional actors while a high level of aggregation could have helped to exclude them completely.

In both cases, it appears to be difficult to draw conclusions on what the best option (low level or high level of aggregation) was for creating manageability. Both a high and a low level of aggregation can have advantages in this respect. Looking from a political rationality, a low level of aggregation can help to address conflicts, recognise interests of individual actors and find issue trade-offs; from a managerial rationality, a low level of aggregation might be time efficient when detailed models are available that can be used. On the other hand, from a political rationality, a high level of aggregation might contribute to preventing conflicts over the details, while from a scientific rationality a high level of aggregation can contribute to the understanding of important processes and parameters. In general, in both cases, some actors mentioned the advantages of starting at a high level of aggregation and working to a lower level if the problem required that.

Examples of factors affected by the selection of level of aggregation that were visible in both the LTV and the WSS are presented in Table 9.12.

Table 9.12: Similar types of effects of the selection of level of aggregation mentioned or/ and observed in both the LTV and the WSS

Effects LTV	Effects, WSS modelling	Effects, WSS presentation	Rationality
Scientific validity	Scientific validity	Scientific validity	Scientific
Recognisability	-	Recognisability	Political
Support	-	Support	
Effectiveness	Effectiveness	Effectiveness	Managerial
Efficiency	Efficiency	-	

Also within the WSS, similarities could be seen in the criteria used for the selection of the level of aggregation for the modelling and the presentation. These similar effects are presented in Table 9.13.

Table 9.13: Similar types of effects of the selection of the level of aggregation in the WSS modelling and presentation

Effect WSS Modelling and WSS Presentation	Rationality
Level of interest Scientific validity	Scientific
Commitment	Political
Action ability	Design
Effectiveness	Managerial

Differences between the cases

The levels of aggregation selected in the LTV and WSS were entirely different. In the LTV, by selecting a general high level of aggregation, the involvement of regional actors was prevented, in order to speed up the process and make it possible to create a long-term vision. Occasionally, a low level of aggregation was selected to recognise the interests of the actors involved. In the WSS, by selecting a low level of aggregation, especially in the modelling, the involvement of regional actors was stimulated. This was also a way to gain knowledge of regional and local problems. The level of aggregation in the WSS turned out to be differentiated due to data and model availability that were different for the different sectors/ disciplines involved. The differences in the level of aggregation between the LTV and the WSS were clearly in accordance with the different characteristics of the studies: the LTV was process oriented and the WSS research oriented. This is also recognisable in Table 9.13. Another difference between the LTV and the WSS was the perceived importance of commitment. In the WSS, the creation of commitment by the regional actors to the water shortage problem during the study was thought to be very important. In order to be able to put this problem on the agenda, their commitment was absolutely necessary. In the LTV, commitment was not considered very important because the political stakes were high, so all actors were committed to the study anyhow.

Examples of factors affected by the level of aggregation that were visible in only one case are presented in Table 9.14.

Table 9.14: Types of effects of the selection of level of aggregation mentioned or observed in one case study

Case study	Effect	Rationality
LTV	Content (problems, options and effects)	Scientific
	Recognition of interests Prevention of conflicts Possibilities of consensus building Openness	Political
	Coherence and broadness of issues, options and effects Integrated character Insight into big picture Need of cooperation	Design
WSS modelling	Clarity of the problem	Scientific
	Communication possibilities Transparency	Political
WSS presentation	Protection of core values Political sensitivity	Political
	Policy relevance Justifiability Match with level of authority	Design

Reflection on the key questions

Both case studies show that it can be impossible to select one level of aggregation and stick with it. This will often be the case because of different requirements of the actors involved, differences in the priorities of problems, and differences in the level of difficulty of problems. It is important to prevent comparing apples and oranges by always being aware of these differences and questioning what they mean for the interpretation of the data, models and expert knowledge.

10. Conclusions, recommendations and reflection

The designer of the path is the one standing at the end of it.

-Amos Jessup

10.1. Preview of the chapter

What can be learned from this research? The aim of this thesis was to provide more insight into the making and handling of scale choices and their effects. Two case studies were conducted in which the making and handling of scale choices were studied in practice. The research questions asked at the beginning of this research provide the structure for this chapter. All the research questions are addressed separately. In the first section of this chapter, the most important findings of this research are summarised. The second part contains guidelines for making scale choices. Also, recommendations are given that support policy analysts in the making of scale choices. Finally, a reflection on issues playing an important role in this research is given. The contribution of this research to policy analysis is clarified and some suggestions for future research are offered,

The first research question was:
1. What role do scale choices play in policy analysis processes on water management?
a) What different perspectives on scale choices exist in general?
b) What are the specific effects of scale choices?
c) What challenges play a role when making and handling scale choices?

This question is answered in Section 10.2 in which the different aspects of the role of scale choices are addressed in the subsections.

The second aim of this research was to provide guidelines for policy analysts in the making and handling of scale choices. The second research question was:
2. How can the making and handling of scale choices be guided in such a way that they contribute to the success of a policy analysis process?
a) How can scale choices be used as a framing instrument to contribute to the success of policy analysis processes?
b) How can the process of making scale choices be designed in such a way that they contribute to the success of the policy analysis process?

Research question 2a is answered in Section 10.3 and research question 2b is answered in Section 10.4.

In Sections 10.5 and 10.6 a reflection on the research is given, first on the approach that was followed and finally on the actors' roles that could be distinguished. Finally, this thesis ends with the contribution of this research, suggestions for future research and some personal closing remarks.

It is stressed that as only two case studies were conducted, the conclusions are tentative. It is rather difficult to judge the generalisability of for example the framing guidelines. Other cases may show additional or different effects.

10.2. Role of scale choices in policy analysis processes

10.2.1. What perspectives on scale choices exist in general?

→ *Different rational perspectives on scale choices exist that consist of essentially different frames*

It is important to realise that different perspectives on scale choices are not only related to the political interests that are involved, but that a deeper layer exists. Essentially different frames play a role that all result in different rational perspectives on scale choices. Table 10.1 gives an overview of these different rational perspectives.

Table 10.1: Overview of different views on scale

Rationality	View on scale	Characteristics
Scientific	Scale as a system related characteristic	System scale plays a key role, but multi-disciplinary views exist on the system scale
Political	Scale as a social construct; an instrument to get what you want	Decision making scale plays a key role Multi-stakeholder views related to interest play an important role
Managerial	Scale as a scoping instrument limited by boundary conditions	The combination of spatial/ temporal scale and the level of aggregation is important
Design	Scale as design decisions	Different design decisions in policy analysis can be distinguished that must be made in the spatial boundary setting, the temporal boundary setting and the selection of level of aggregation: • Observation scale • Analysis scale • Presentation scale

10.2.2. What are the specific effects of scale choices?

→ *Scale choices have large effects on the content, the process and the outcome of the study*

The spatial boundary setting, the temporal boundary setting and the spatial level of aggregation were studied separately. This made it possible to compare the types of effects that were observed and the criteria that were mentioned by the different actors for each of the scale choices. All scale choices in the case studies confirm the close relationship between scale choices and the goal of the study. The case studies also warrant the identification of different actor perspectives, and the focus on value trade-offs that have to be made when designing a policy analysis process. The main lesson is that scale selection is an important framing instrument that can be used by both the policy analysts and the other actors involved.

The case studies confirm that scale choices matter and have important effects. Effects were observed related to all rationalities, confirming that these rationalities play an important role in the making of scale choices.

One of the most important effects of scale choices is that they contribute to the framing of the content of the study: in a policy analysis process, scale choices are crucial because the adoption of a particular scale sets limits on the types of problems that can be addressed, the kinds of solutions that can be found and the effects that are evaluated. Also, it determines what kind of problems, options and effects are excluded. Policy analysis results are sensitive to scale. The temporal and spatial scales and the level of aggregation influence the number and types of issues that are studied, the number and types of solutions that are involved and the number and types of effects that are evaluated. The level of aggregation also influences the depth of the issues, solutions and effects that are being studied.

Scale choices also influence the process, for example the number and types of actors that are involved, the possibilities for consensus building and the political sensitivity. The involvement of actors is influenced by the spatial boundaries and the level of aggregation. Although the level of aggregation is often handled in a flexible way, the starting point is crucial because it determines whether regional and local actors want to be involved or not. In the temporal boundary setting, no effect was observed on the involvement of actors, nor on the dedication and criticalness of them. It can be noticed, however, that different people from an organisation can become involved: if a shorter term is selected, more practical people are involved than when a long term is selected. The dedication and criticalness of actors also depends on the spatial scale of the project. This was already described in Section 3.5.3 and was confirmed in different ways in the case studies. In the LTV, it was noted that regional actors fell out of scope due to the high level of aggregation. At the end of the study, a lot of regional actors were not happy with the results of the study. In the WSS, it was observed that at the start the regional actors felt less committed to the study because of the selection of the national scale. The project team wanted them to become involved and therefore secured their interest in the study through the selection of a low level of aggregation. This made the study interesting for them because models were constructed that were very useful for them.

Table 10.2 summarises the different effects of the different scale choices on the system analysis and the actor analysis.

Table 10.2: Effect of changing scales on the system analysis and the actor analysis

Scale choices	Change	System analysis	Actor analysis
Spatial scale	Larger	*Expand systems scope:* new exogenous factors, internal variables and options appear; exogenous factors may become internal variables or options	Larger scale actors may become involved. Critical actors may become non-critical and vice versa, dedicated actors may become non-dedicated and vice versa.
	Smaller	*Limit systems scope:* exogenous factors, internal variables and options disappear; internal variables and options may become exogenous factors	Larger scale actors may not be involved anymore. Critical actors may become non-critical and vice versa, dedicated actors may become non-dedicated and vice versa.
Temporal scale	Larger	*Expand systems scope:* new exogenous factors and internal variables appear; exogenous factors may become internal variables	Corporate actors do not change, but from the involved organisations more strategic people become involved
	Smaller	*Limit systems scope:* exogenous factors, internal variables and options disappear; internal variables may become external variables	Corporate actors do not change, but from the involved organisations more operational people become involved
Level of aggregation	Higher	Exogenous factors, internal variables and options may become invisible	Regional and local actors may disappear
	Lower	New exogenous factors, internal variables and options may become visible	Regional and local actors may become involved

→ *Many types of effects were mentioned by the actors involved*

Table 10.3 shows the typical types of effects (criteria) that were mentioned for the different scale choices.

Table 10.3: Types of effects related to scale choices

Category	Spatial boundary setting	Temporal boundary setting	Selection of level of aggregation
Common to all scale choices	Scientific validity Possibilities for consensus building	Scientific validity Possibilities for consensus building	Scientific validity Possibilities for consensus building
Related to the spatial and temporal boundary settings	Shift ability of the problem (to another place) Action ability Coherence in options Decision making ability Number of options Possibilities for model building Disciplinary relevance Justifiability Complexity	Shift ability of the problem (to the future) Action ability Coherence in options Decision-making ability Number of options Possibilities for model building Disciplinary relevance Justifiability Complexity	

Related to the spatial boundary setting and the selection of level of aggregation	Involvement of actors Time efficiency Inclusion of issues		Involvement of actors Time efficiency Inclusion of issues
Related to the temporal boundary setting and the selection of level of aggregation		Interestingness Overseeing ability Model reliability	Interestingness Overseeing ability Model reliability
Unique criteria to spatial boundary setting	Focus on the agenda Coherence of issues		
Unique criteria to the temporal boundary setting		Robustness of options Efficiency of options Possibility to take into account uncertainties Sense of urgency Realisation possibilities of solutions	
Unique criteria to the selection of level of aggregation			Disputability of knowledge in the team of experts Policy relevance for local issues Need for cooperation Available data Importance and urgency of the problem

From Table 10.3 it can be concluded that spatial boundaries, temporal boundaries and levels of aggregation have somewhat similar and somewhat different effects. All scale choices have an effect on the scientific validity and on the possibilities for consensus building.

The differences in criteria used in the arguments for the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation raise an important question: what makes these scale choices so different? An obvious difference between the temporal and spatial boundary settings is that spatial boundaries can have up to three dimensions (length, area, volume) while time always has one, and time is unidirectional (Scholes et al., 2002). Therefore, spatial boundaries have more degrees of freedom. The spatial boundary setting determines what is taken into account and what is not; it determines the extent of the issue under study. For example, in the LTV, it was determined that water quality was not taken into account. Then, the spatial boundaries could be selected in such a way that water quality is an exogenous factor and not an internal variable. It is easy to be flexible in the spatial boundary setting because internal variables can easily turn into external variables by scaling down. When scaling up, exogenous factors may become options or internal variables.
Temporal boundaries do not have that intrinsic flexibility because of the different dimension of processes on different time scales. Processes studied in the short term or long term often have a completely different nature. This is also visible in the criterion *robustness of options*. Only if long temporal boundaries are used can the robustness of options be taken into account. The level of aggregation appears to be a very different choice from the spatial and temporal boundaries. The level of aggregation may vary within the studies depending on the subject under study. For each subject a new trade-off can be made. An important decision criterion

for the selection of the level of aggregation is whether it is worth taking details into account: Are details needed for decision making?

→ *Different types of criteria play a role*
During the process of identification of criteria, it appeared that different types of criteria played a role. In general, two types of criteria can be recognised:

- Criteria that anticipate certain expected effects (causal) (presented in Chapters 7, 8 and 9 and in Table 10.3)
- Criteria that are boundary conditions at the start (Table 10.4).

Table 10.4: Boundary conditions for making scale choices

Boundary conditions	**Related to rationality**
• Data/ model constraints o Data availability (WSS) o Model availability (WSS) o Data gathering possibilities (WSS) o Modelling possibilities (WSS)	Scientific
• Available time (LTV) • Available budget (LTV)	Managerial
• Presence of adjacent research projects (LTV)	Design
• Fit with legal framework (LTV) • Overlap with other arenas and treaties (LTV) • Possibilities to line up with other plans (LTV) • Interference with other plans (LTV)	Political

From Table 10.4 it can be concluded that in the WSS more boundary conditions related to the scientific rationality played a role, while in the LTV more boundary conditions related to the managerial and political rationalities played a role, which can easily be explained by the different nature of the studies.

10.2.3. What challenges play a role in the making of scale choices?

Four typical challenges were distinguished. Three challenges are related to the making of scale choices: dealing with the multi-stakeholder views on scale, dealing with the multi-disciplinary views on scale, and making scale choices to contribute to efficiency. The fourth challenge involves a specific issue in the handling of scale choices during the policy analysis process: handling scale discrepancies between models/ answers and policy questions. Table 10.5 shows to what extent the scale-related challenges were observed in the case studies.

Table 10.5: Presence of scale-related challenges

Challenge	LTV	WSS
1: Dealing with the multi-stakeholder views on scale	Major role, could clearly be recognised at the start of the process	Minor role, the consequences were not very severe so not considered crucial
2: Dealing with the multi-disciplinary views on scale	Initially a minor role because all the researchers worked on their own preferred spatial scale. Towards the end a major role because the policy analysts had to integrate all the information	Minor role, the challenge was more related to handling the different levels of aggregation of the available data in the different disciplines
3: Making scale choices in such a way that they contribute to the achievement of objectives within the boundary conditions	Major role, the boundary conditions (especially finishing on time) were crucial	Minor role, the boundary conditions were not crucial
4: Handling scale discrepancies between models/ answers and policy questions	Played an important role in the end and had to be handled by the policy analysts	Played mainly when thinking about the presentation of results (mainly level of aggregation)

10.3. Scale choices as a framing instrument: design of framing guidelines

The need for guidelines related to scale was referred to earlier (João, 2002). Some guidelines exist already. For example, in relation to the spatial scale, O'Neill et al. (1996) recommended that in reporting landscape patterns, the grain size should be 2 to 5 times smaller than the spatial features of interest. In relation to the temporal scale, Laube and Purves (2006) suggested that in order to search for seasonal migration patterns, an analysis granularity of hours would not be adequate because it might introduce noise caused by daily movement patterns, i.e. *can't see the woods for the trees*. These guidelines are clearly research-oriented. The guidelines that are developed in this chapter are called 'framing guidelines' because they intend to support the framing of the content and the process of the study. They have a specific focus on the policy analysis process in which multiple stakeholders and multi-disciplinary researchers are present.

Because of the different actor perspectives and different types of goals in policy analysis, no general, normative guidelines can be formulated on how scale choices should be made in policy analysis. The absence of such normative guidelines causes ambiguity and the possibility that scale choices can be used for personal gain.

In Chapters 7, 8 and 9, the effects of scale choices were described in retrospect. To be able to say something about their effects when looking forward in the design of policy analysis processes, the logic of the consequences of scale choices is translated into framing guidelines. Framing can be defined as the creation of a specific, selective problem formulation by putting things in a certain perspective (Schön, 1983). It is often related to the process of agenda setting and is then addressed as framing the problem. "The resulting state is a framed issue: a real-world phenomenon that has been given form and meaning in a certain actor-related perspective" (Carton, 2007, p. 70). Here, the framing guidelines indicate how scale choices offer opportunities and can be used as a strategic instrument (for example by the policy analyst) to influence/ frame the study and the results of the study. Care has been taken to construct framing guidelines that are more broadly applicable than just in the case studies.

It was noted earlier and is stressed again that establishing causal relationships is always a difficult matter in case studies. In experimental settings, variables can be isolated and therefore the effects that are observed are directly related to these isolated variables. In practice, however, this is never feasible. A lot of circumstantial issues or events play a role in the effects observed. Being based on the two case studies, the framing guidelines proposed in Table 10.6 are plausible for similar contexts.

Table 10.6: Framing guidelines for the spatial boundary setting (based on observations in the LTV and WSS)

	Scientific rationality	**Political rationality**	**Design rationality**	**Managerial rationality**
Select larger spatial boundaries if you want to….	Get a better perspective of the context of the problem (LTV/ WSS)	Increase the number of issue trade-offs that are possible between the actors involved (LTV)	Prevent ignoring of impacts on a larger system scale (WSS)	
		Increase the balance between actors involved (LTV)	Increase the number of issues (LTV)	
			Increase the number of options (LTV)*	
Select smaller spatial boundaries if you want to…	Decrease the complexity because at larger scales more relations have to be taken into account (LTV/ WSS)	Decrease the dependency of actors on larger scales (upstream countries) (WSS)	Increase the action ability, at larger scales more actors (river basin) would have to be involved (WSS)	Increase the action ability by decreasing the number of actors involved (LTV)
	Make it easier to locate problems (WSS)	Prevent a wait attitude with actors with authority on a lower spatial scale (WSS)		Decrease the time needed for the study (LTV)
		Contribute to keeping delicate, unsolvable issues out of the scope (LTV)		Increase the focus on the agenda (LTV/ WSS)
.		Contribute to keeping actors with conflicting interests out of the scope (LTV)		Increase the manageability (WSS)
		Contribute to the autonomy of the actors involved and therefore to the willingness to cooperate (LTV)		
		Increase the commitment of actors at a lower scale (WSS)		

* It should be noted that in the case study of the WSS, a smaller scale led to an increase in the number of options (WSS). This is however regarded as an exception. The basic assumption, that a larger scale leads to an increase in the number of options, is confirmed.

Table 10.6 shows that in the managerial rationality no arguments were found to select a large spatial scale. This is not surprising as a larger spatial scale in both cases would not have contributed to the manageability.

Table 10.7: Framing guidelines for the temporal boundary setting (based on observations in LTV and WSS)

	Scientific rationality	**Political rationality**	**Design rationality**	**Managerial rationality**
Select larger temporal boundaries if you want to….	Take uncertainties into account (LTV/ WSS)	Contribute to consensus building by overcoming short-term differences (LTV)	Stimulate the creativity, thinking beyond business as usual (LTV/ WSS)	
	Take return on investment into account (LTV/ WSS)	Create an ambitious far-reaching vision (LTV)	Increase the number of options because long-term structural solutions can be included (LTV/ WSS)	
		Contribute to the ecological concerns (LTV)		
		Generate sustainable options (LTV)		
Select smaller temporal boundaries if you want to…	Contribute to the predictability (LTV/ WSS)	Create a large sense of urgency (LTV/ WSS)	Increase the action ability (LTV)	
	Contribute to the overseeing ability (LTV)	Contribute to the economic concerns (LTV)	Prevent a shift of the problem into the future (WSS)	

Table 10.7 shows that from the cases no framing guidelines for the temporal boundary setting related to the managerial rationality could be constructed. The reason is that in the cases hardly any effects of the temporal boundary setting were mentioned or observed that were related to the managerial rationality.

Table 10.8: Framing guidelines for the selection of level of aggregation (based on observations in the LTV and WSS)

	Scientific rationality	**Political rationality**	**Design rationality**	**Managerial rationality**
Select a higher level of aggregation if you want to….	Contribute to the general understanding of the important processes and parameters (WSS model)	Contribute to consensus building by preventing discussion and conflicts on the details and keeping potentially conflicting issues out of the scope (LTV/ WSS pres)	Contribute to visibility of the integrated approach (LTV)	Secure progress of the study when disagreements exist (LTV)
		Keep local and regional issues out of the scope (actors who are concerned with those issues are not involved) (LTV)	Contribute to an emphasis on the coherence of issues, solutions and the integrated character of a study (LTV)	Contribute to the time efficiency of the study (LTV/ WSS model)
		Contribute to the recognition of the interests of the national political actors involved (WSS pres.)	Contribute to a clear, oversee able big picture (WSS mod/ LTV)	Contribute to keep the number of actors involved limited (LTV)
		Contribute to the need for cooperation (LTV)	Contribute to flexibility (WSS model)	Contribute to long-term vision building (LTV)
			Limit the number of issues (LTV)	
Select a lower level of aggregation if you want to	Resolve differences of opinion between experts (LTV)	Contribute to the recognisability for actors involved (WSSmod/ WSSpres)		
	Contribute to the scientific validity (LTV)	Contribute to the recognition of the interests of the regional political actors involved (LTV/ WSS mod/ WSS pres.)		
	Contribute to the validation possibilities (WSS model)	Contribute to consensus building when more issue trade-offs are needed (LTV)		
	Make it possible to judge the reliability of the results (WSS mod/ WSS pres)	Create commitment and support for the study with the regional actors (WSS mod/ LTV)		
	Contribute to optimisation possibilities (WSS model)	Convince people that large and expensive measures are worthwhile taking (WSS model)		
	Contribute to a feeling of security (WSS model)	Contribute to the transparency (WSS mod/ WSS pres)		

From Table 10.8 it can be concluded that the cases show no arguments to select a low level of aggregation from either a design or managerial rationality. From a managerial rationality this could be expected because of efficiency reasons, from a design rationality, however, that is not so. If more cases were studied, it would be expected to find some guidelines in favour of the selection of a low level of aggregation from a design rationality.

10.4. Ten recommendations for the process of making scale choices

Because scale choices have important consequences, policy analysts have to make and handle scale choices conscientiously and carefully. In order to be able to do that, recommendations are being given related to the choosing process. The findings and the guidelines that were presented in the previous section are elements in this process, but the process recommendations are much more comprehensive. These recommendations can be used to organise the process. The recommendations (also called a framework for design reflection) may help policy analysts to assess the impacts from multiple perspectives, to clarify dilemmas and trade-offs to be made, and to make deliberate scale choices. The steps to be taken are: (1) exploration of the problem of making scale choices, (2) design of scale options, (3) evaluation of scale options, (4) decision: making the scale choice. It may not come as a surprise that this sequence of steps is remarkably similar to the sequence depicted in Figure 2.1; it can therefore be regarded as a miniature policy analysis within the policy analysis process. In brief: *perform an 'impact assessment of scale choices' in the early stage of any policy analysis process* (Karstens et al., 2004a).

Step 1. Exploration of the problem of making scale choices

Recommendation 1: Determine the goal(s) of the study and the managerial constraints

At the start of the process of making scale choices, it is important to gain clear insight into the goals that the scale choices need to contribute to. This can be done by using the hexagon model presented in Figure 2.4 as a checklist: Which of the goals mentioned in this model is relevant in the study? Also, insight is needed in the managerial constraints: Is the budget tight? Is the study urgent and is the time therefore limited?

Recommendation 2: Do a controversy scan to estimate the scale-controversy potential

An important question to ask is whether the scale choice to be made is potentially controversial. A scale choice is potentially controversial when conflicting preferences exist and actors attach great value to the consequences of the choice (for example threatening to their own position). The controversy scan in box 10.1 can be used to estimate the scale-controversy.

Box 10.1: Checklist of factors that contribute to controversy on scale choices

- Dedicated actors on different spatial scales play a role with different interests on different scales
- Actors have conflicting objectives that play on different spatial scales or time scales
- (for example economic (short term) versus ecological (long term))
- Different objectives of study exist that benefit from different scales
- An unequal costs and benefits distribution between actors on different scales may lead to conflicts/ resistance and limited support
- The study is close to the policy making process

If the scale-controversy potential appears to be high, then steps 2, 3 and 4 have to be executed thoroughly.

Step 2: Design of scale options
In this step the options for scale choices are determined.

Recommendation 3: Design of options for scale choices also in consultation with the actors involved

This is the trick of the trade of the policy analysts: they have to design options for scale choices. To do so, they can use their own skills and experience but also consult the actors involved. During the execution of the case studies, it appeared that the actors involved had many useful ideas for scale options. To expand the broadness in scale options, it is therefore considered important to consult the actors involved in the design of options.

Step 3: Evaluation of scale options

Recommendation 4: Determine expected effects of scale options from multiple actor views

The expected effects of scale options can be determined by using the criteria checklists presented in table 10.3. System diagrams and actor analysis diagrams should be used to gain more insight into the different alternatives.

It is possible to assess the effects of scale choices value-free, but effects need to be translated to a value. For example, in the LTV, a value-free effect is that the water quality issue becomes involved when scaling up to the river basin. Values become attached when actors judge that effect. Some judge the effect negatively, for example: actor x says: bad, because it is an important issue that should be taken into account (so, he relates it to the validity of the study). Some judge the effect positively, for example actor y says: good, because it is a delicate issue that is not easy to solve (so, he relates it to the political sensitivity and solvability). The effects can be presented with score cards and the values of the actors can be included as well.

Policy analysts should take those subjective judgements into account and relate them to the objective of study (see also Recommendation 9). By comparing the score cards, closer insight can be gained about the potential controversy on scale choices. Also, the dilemmas that can be expected can be identified and visualised.

Recommendation 5: Identify expected dilemmas related to scales choices

The case studies showed that the tension bows offer possibilities to make the dilemmas tangible and visible. To be able to do that, it is necessary to pair the options that are considered potentials.

Recommendation 6: Make options for scale choices, impacts of options and dilemmas transparent and discuss them with the actors involved in the policy analysis process

The workshop held at the start of the Long-Term Vision of the Scheldt Estuary Study showed that even in a highly political and controversial setting it is feasible to discuss different options and their consequences with the actors involved. This would be an important way forward in a collaborative design of policy analysis processes. Policy analysts explore the different options available by interviewing different actors involved. Next, the options, their advantages and disadvantages are discussed in a workshop in which all the important actors involved in the study are present and the process is facilitated by policy analysts. A dialogue on design choices may contribute to transparency and mutual understanding. Also, it may contribute to make aspects of strategic behaviour visible in an early stage of the policy analysis process.

Recommendation 7: Be aware of strategic handling of scale choices by actors involved

As could be learned from theory and observed in the case studies, scale can and often will be used as a strategic instrument by actors involved in a policy analysis process. The Long-Term Vision provided some examples of accusations of strategic handling. The Flemish accused the Dutch of starting a study with shelving in mind (postponing the decision on deepening by a comprehensive study). Also, the fact that the Dutch wanted to include a longer term than the Flemish was regarded as a sign that confirmed this. The Dutch accused the Flemish of starting a study with rationalisation in mind (a quick decision in favour of the deepening) and therefore did not want anything included that was not related to the deepening. Strategic considerations related to putting the problem on the agenda could be observed clearly in the reactions of the actors involved. Table 10.9 shows some examples of strategic behaviour in making scale choices that policy analysts need to be aware of.

Table 10.9: Plausible strategic considerations in making scale choices

Interest of an actor	Strategy	Actors may be in favour of a......
Putting on agenda a certain problem he/ she considers important	Make scale choices in such a way that they contribute to getting the issue central on the agenda Fade out other problems that are considered less important (or unsolvable) by the selection of a smaller spatial and/or temporal scale and a high level of aggregation	Spatial and temporal scales on which the problem he/she wants to address is dominant Spatial and temporal scales on which the other problems fade into the background
Rationalising in favour of a certain solution	Let positive effects look more positive and let negative effects look less negative	Spatial and temporal scales that place this solution prominently on the agenda and ignore other options High level of aggregation to underplay negative information in the details Spatial or temporal scales on which negative consequences are not immediately visible: • (Large) scale if it is possible to average out the effects of measures • Limited scale if the solution has negative effects on a larger scale
Shelving to delay the study	Involve everything and everyone	• Scale on which many stakeholders are involved • Large spatial and temporal scale in combination with low level of aggregation
Hurrying the study: because urgent interests are at stake	Take what is out there and do it quick	• Limited time scale for information support • Small spatial boundaries and a high level of aggregation, • Select a scale on which information and models are readily available
Shirking by shifting the problem to another actor	Shift problem to a larger scale or into the future	• Select a scale on which the actors involved have no authority • Show the difficulty of finding solutions on this specific scale

Step 4: Decision: making the scale choice

> **Recommendation 8: Address the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation together because the choices influence each other**

It is important to determine the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation in policy analysis together in one study because the scale choices have a close relationship to each other. The negative impact of one choice may be compensated by another choice.

Recommendation 9: Make scale choices fit with objectives of study and the boundary conditions

Fit with objective of study

As was concluded in Chapter 3 and observed in the case studies, scale choices have a close relation to the goal(s) of the study. Therefore, it is important to make scale choices in such a way that they contribute to the study's goal(s). Table 10.10 provides guidelines to make scale choices fit. These guidelines are closely related to the framing guidelines but are meant to serve as a check with the goals.

Fit with boundary conditions

No matter the goals of a policy analysis process, always boundary conditions play a role. These can be managerial constraints, data/ modelling constraints or contextual constraints. Table 10.4 provides an overview of the boundary conditions that need to be taken into account.

Also, it is important to make scale choices fit with the managerial constraints. Managerial constraints play a more prominent role in some situations than in others. Considering the managerial constraints, the LTV and WSS showed clear differences. In the LTV, the managerial constraints played a very important role, the available time was limited and it was considered very important to finish on time. This influenced the making of scale choices and led to a limited spatial scale, a large time scale combined with a high level of aggregation. In the WSS, managerial constraints played a less important role because the issue was not considered urgent. The fact that the study was delayed for more than a year did not matter very much to the actors involved. Also, the extra costs were considered to be no problem by the commissioners. They considered it more important to have a good analysis of the problem. The conclusion can be drawn that the role that managerial constraints play depends a lot on political sensitivity and the urgency to solve the problem. In the making of the scale choices, the importance and the limiting nature of the managerial constraints should be taken into account. Box 10.2 provides some guidelines that are helpful in the case of important and rigid managerial constraints.

Box 10.2: Guidelines that are helpful in the case of important and rigid managerial constraints

1. Select a scale that is manageable
2. Balance the selection of temporal/ spatial scale and the selection of the level of aggregation as much as possible (context versus detail):
   a. Combine a small spatial/ temporal scale with low level of aggregation
   b. Combine a broad spatial/ temporal scale with high level of aggregation
3. Make the scale choices in such a way that they match as much as possible with the scale of the available models and data.

Of course, it is also important to take the actors' opinions into account, because the choices made must not meet too much resistance.

Table 10.10: Guidelines for making scale choices fit with the goal(s) of the study

Goal	Scale choice should contribute to…	Guidelines (to make scale choices that contribute to the fulfilment of the goal of the study)	Typical criteria
Research and analyse	Quality of the assessment	Characteristics of the system under investigation play an important role in the selection of scale	Validity of the study
Design and recommend	Policy relevance (action oriented) and broadness of options	Take into account the level of influence of the commissioner of the study Create more solution space and prevent premature closure by selecting a broad and long-term scale for designing policy options	Creativity Number of options Solvability of the problem Sense of urgency Realisation possibilities of the solutions
Mediate	Consensus building and support	Select a wide time scale because that makes it much easier to reach consensus than on urgent short-term issues Select a scale that excludes actors with conflicting interests (may not be good for long-term progress) Select a high level of aggregation because the devil is often in the details (details can be worked out later) Remove the sting out of a conflict by: - Upscaling to get more solutions into sight in case of a deadlock - Upscaling when an actor that may influence the problem in a positive way gets involved - Upscaling in conflicts between actors that may have the same interest on a higher scale (resolve deadlock situations) - Looking on a higher level of aggregation: who wins and who loses disappears	Number of actors involved Protection of interests Possibilities for consensus building Possibilities for protection of interests
Democratise	Providing openness and transparency	Contribute to the openness of the process: all relevant information for all stakeholders should be visible and understandable, e.g. not hiding essential information but also not too many technical details that may hide the forest for the trees.	Match with level of interest of the stakeholders Transparency
Advise strategically	Achievement of the goals of the commissioner	Very situation specific, depends on the wishes of the commissioner, so no general guidelines can be constructed	Protection of interests of the commissioner
Clarify arguments and values	Quality of debate	Very situation specific	Transparency

Recommendation 10: Use a multi-scale quick scan at the start of the study and if needed a multiple scale approach in the study

In the WSS, a multi-spatial scale and a multi-temporal scale approach was promoted and used from the start. In the LTV, a multi-temporal scale approach was used from the start. Also, the LTV showed that, when needed due to the rise of problems on the selected spatial scales, larger spatial scales and smaller levels of aggregations were used. So, the multi-spatial scale approach partly emerged during the study. Both studies showed that working on multiple scales can offer chances for solving conflicts and creating commitment.

In the literature the need for multi-scale analysis is stressed frequently (Rotmans, 2003; Sarukhán, 2003; Berkes, 2002; Capistrano et al., 2005). Just as addressing problems from the perspective of a single discipline or sector can result in an incomplete and often problematic picture of society and societal concerns, so can focusing on a single scale and ignoring the interactions between and across scales. The ultimate effect is that decisions will be made and actions taken that may be inappropriate and, at times, counterproductive (Rotmans, 2003). Outcomes at a given scale are often heavily influenced by interactions of ecological, socio-economic, and political factors emanating from other scales. Thus, focusing solely on a single scale is likely to miss interactions with other scales (Sarukhán et al., 2003). Many cases in integrated water management are neither small scale nor large scale, but cross-scale in both space and time. As such, management problems have to be tackled simultaneously at several levels (Berkes, 2002; Capistrano et al., 2005).

Although this research shows the importance of multi-scale analysis, it is acknowledged that this analysis also may take more time and effort due to its increased complexity. Therefore, starting on a global level and checking which questions can be answered and which ones cannot is always recommended. Questions are often not very clear at the beginning and are reformulated during the process. Often, no broad and superficial analysis is done but partial problems are immediately selected and investigated in detail, without placing them in context or in the bigger picture and without understanding the mechanisms that are behind it. The start of the modelling process in the WSS is a good example of this.
It is also recommended to perform a quick scan multi-scale analysis at the beginning of the study to clarify relationships and interactions between the different scales. The system diagrams that were constructed in the thought experiment show these relationships. By gaining insight into these linkages, it is possible to avoid the pitfall of the problem shifting towards another scale because cross-scale interactions are insufficiently taken into account. By doing a quick scan, it can also be determined how the effort in the study should be managed. What are the big issues? For each problem the suitable level of aggregation should be determined. Dominant problems should be studied in greater detail than minor issues. This contributes to more balanced attention to all issues that are relevant in the study.

Make scale choices explicit during the process and in documents
It is important to make scale choices explicit in the remainder of the process and in project documents. Also, it is important to justify what reasons were present to make scale choices in such a way.

Making scale choices explicit contributes to transparency and prevents a Babel-like confusion of tongues when everyone is talking on or about different scales. Sometimes, this confusion may even be functional in the process because it also may hide differences, but often this will result in miscommunication and irritation. Actors can get into an argument over ‘nothing’ when they are reasoning at different levels of scale because they observe different patterns that do not logically match. De Jong (1992) addresses this phenomenon as the ‘scale paradox’. He found that in communication on spatial phenomena, a switch between scales may take place that results in paradoxes that make a discussion impossible.

Overview

It is of course realised that the framework for design reflection is quite elaborate and not usable in each situation. Each situation may lead to different requirements, so elements of the sketched approach can be used as well. Table 10.11 shows all the steps. It is emphasised that the steps that are mentioned on the right side of the table are comparable to the steps taken in policy analysis in general. The making of scale choices involves a ‘miniature policy analysis’ of its own (Karstens et al., 2007).

Table 10.11: Overview of framework for design reflection

Recommendation	**Supporting tools**	**Step**
1. Determine the goal(s) of the study and the managerial constraints	Figure 2.4 Hexagon model	*Exploration of the problem of making scale choices*
2. Do a controversy scan to estimate the scale-controversy potential	Box 10.1 Checklist controversy scan	
3. Design of options for scale choices also in consultation with the actors involved	-	*Design of scale options*
4. Determine expected effects of scale options for both the content and the process from multiple actor views	- System analysis diagram - Actor analysis diagram - Table 10.3 Criteria checklist	*Evaluation of scale options*
5. Identify expected dilemmas related to scale choices	Tension bow diagrams	
6. Make options for scale choices, impacts of options and dilemmas transparent and discuss them with the actors involved in the policy analysis process	Score card with arguments of actors involved	
7. Be aware of strategic handling of scale choices by actors involved	Table 10.9 Plausible strategic considerations	
8. Address the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation together because the choices influence each other		*Decision: making the scale choice*
9. Make scale choices fit with objectives of study and the boundary conditions	- Table 10.10 Guidelines for fit - Box 10.2 Managerial constraints - Tables 10.6, 10.7, 10.8, framing guidelines	
10. Use a multi-scale quick scan at the start of the study and if needed a multiple scale approach in the study		

10.5. Reflection on the approach

Conceptual framework was useable, minor addition needed
The conceptual framework shown in Figure 4.1 was well usable. In the framework, the input was defined by actors' views on scale alternatives. The cases showed that a number of contextual factors played an important role in the decision-making process in addition to their views, such as data availability, fit with other projects, fit with legislation and overlap with other arenas.

Actor archetypes were helpful in classification
The categorisation of the actors involved into actor archetypes was discussed during the interviews. Each actor was asked to classify his/ her role in the study using the typology of actor archetypes. Although most actors could easily classify themselves in the actor archetype model, four exceptions are worth mentioning here. The exceptions all had to do with the feeling that actors played more than one role during the study.

In Chapter 4 it was concluded that the commissioner often has a political rationality because he often also has a political interest at stake. The remark by the commissioner in the LTV confirms this:

> *I would position myself in between the commissioner and the political actor. At the time of study I was the director of Rijkswaterstaat Zeeland, so I was in charge of the management of the Western Scheldt, from that point of view I was a stakeholder and I had to protect my own regional interests. On the other hand, it was my job to provide the budget of the study and to get a project team organised.*

Also one of the political actors in the LTV felt that he was wearing different caps in the study. He was involved as a political actor and as an economist. This is often the case with researchers who are working for a political actor. Within their organisation, such an actor will often play the role of researcher. But outside the organisation, he represents the organisation and therefore will often act as a political actor.

Some double roles appeared in the WSS as well. For example, the project leader of RIZA who was classified as a policy analyst was also the commissioner of the study.

Initially, the representatives of the regions involved were thought to indirectly represent the decision makers in the policy making process. In the evaluation this assumption turned out to be false, as they regarded themselves mainly as experts and not as stakeholders (de Groen, 2003). This caused some confusion, also during the process, because initially other involved actors thought that these regional actors represented the political actors.

In conclusion, the model of actor archetypes generally was very helpful, but it is important to note that actors may occasionally play more than one actor archetype role. This model might therefore also be helpful for policy analysts to discuss the roles the actors play during the process to gain a better understanding of the position of the actors involved.

Thought experiment was useful, but difficult to construct for selection of level of aggregation

The spatial scale and the time scale were relatively easy to analyse by identifying different alternatives and the typology of actor archetypes. Analysis of the level of aggregation proved to be less unequivocal. It appeared to be rather difficult to discuss the general level of aggregation with the actors involved because the choice of the level of aggregation was made continuously during the project and depended on the object under study at that moment. It was interesting to find out what aspects in particular determined the level of aggregation that was selected and under what circumstances.

Observation method and interview method influenced the results

The influence of the researcher can be large. The term 'Hawthorne effect' is now widely used to refer to the behaviour-modifying effects of being the subject of a social investigation, regardless of the context of the investigation (Dictionary of Sociology, 1998). A remark by a policy analyst in the Water Shortage Study illustrates the Hawthorne effect:

> *Only the fact that you joined the meetings and told us that you were going to observe the process of making scale choices made us more conscious of this topic and made us handle it more carefully.*

This might over-emphasise the importance of scale choices to the result. The only solution might be to express the goal of the research in vague and abstract terms, like research on how design choices in policy analysis are made. To be able to get involved in a case study, the actors involved, however, will often want to know what the subject of the research is.

The way questions are asked influences the way the interviewees think (van de Lugt, 2006). A number of examples are given here that are considered important in this respect:

- *Bias in preferences when looking back*
  Asking people their preferences after the study may not reflect their preferences when the study first started. The preferences that they mention when looking back may be biased by the results of the study. This was handled by asking them the arguments in favour of and against each alternative before asking them for their preferences directly. Because the actors were looking back, they had more insight into the effects of the scale choices made, and when performing the thought experiment they could take these into consideration. It is likely that this backwards look resulted in a more sophisticated view of the criteria than when they would have been asked beforehand to mention arguments in favour of and against different scale alternatives. However, the *ex ante* and *ex post* rationality in making decisions may have played a role. Once the decision is made, arguments are lined up for legitimizing the chosen option (Carton, 2007). It would therefore be better to check the preference at two points (at least) during the process of the study: before the project starts and after the project has finished. Also, it would be advisable to monitor preferences during the process. In that way it would be possible to monitor changes and what triggers these changes.
- *Implicit choices become explicit when looking back*
  When analysing *ex post*, it can be observed that people address implicit choices that were made during the process as if they had been explicit and deliberate choices with well-considered arguments. This was also commented upon by the policy analyst involved when reading the case study report of the Long-Term Vision.
- *Arguments often related to a comparison with the selected alternative*
  When arguments are asked that are related to a certain alternative, people will

(subconsciously) compare it to the selected alternative. This bias is taken into account in the way the score cards are constructed.

- *The order of the alternatives mentioned in the interview influences the number of arguments*
  For example, in the LTV for the 'Scheldt Estuary excluding the tributary rivers' alternative, which was selected as a spatial boundary and one of the last alternatives mentioned in the interviews, few arguments in favour of and against it were mentioned by the actors because the actors had already mentioned a lot of arguments when they commented on earlier alternatives.

Data analysis: aggregation of results was difficult
The aggregation of results appeared to be a difficult issue because the richness of the arguments was great, especially in the LTV. For the spatial boundary setting in the LTV, more than 50 different arguments were mentioned. This might be handled more efficiently by asking the interviewee to prioritise the arguments after they are mentioned. Also, arguments appeared to be related to each other: some arguments were the consequence of other arguments, for example limited spatial scale leading to limited number of actors leading to manageability of the study. This problem was handled by constructing causal diagrams of the effects, such as those in Figures 7.13, 7.21, 8.5, 8.9, 9.2, 9.5 and 9.10.

Construction of dilemmas was sometimes difficult
During the construction of the tension bows, it sometimes appeared to be quite difficult to find two related values for each alternative. Therefore, some tension bows are quite obvious while others are more far-fetched. Also, tensions bows are limited to two alternatives. In these cases this was no problem because it was quite clear which two alternatives played the most prominent role. In other cases this might not be as clear and then more than one tension bow should be constructed to compare all relevant pairs.

Studying the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation in policy analysis together had added value
It was interesting to study the spatial boundary setting, the temporal boundary setting and the selection of the level of aggregation in policy analysis together in one study because the scale choices have a close relationship to each other. By studying all of these together, it could be observed that scale choices can compensate for each other's negative effects. Table 10.12 provides an overview of the observed relationships, below the table the observed relationships are explained with more depth.

Table 10.12: Observed relations in scale choices

Spatial boundary setting	Temporal boundary setting	Selection of the level of aggregation	Explanation	Case
X	X		1	LTV
X	X		2	LTV
X		X	3	LTV
	X	X	4	LTV
X		X	5	LTV
X		X	6	WSS
X	X		7	WSS
X	X		8	WSS

1. The spatial and temporal boundaries were considered to be closely linked by economy. It was impossible to make long-term predictions for one local port because predictions on economy over the long term were very uncertain. It was therefore only possible to use a large spatial scale, for example for the Hamburg-Le Havre range. The reason for this was that port developments were mainly based on the individual decisions of the shipping companies.
2. The spatial and temporal boundaries were considered to be closely linked in morphology. A large spatial scale required a large temporal scale in morphology. When studying the spatial boundaries of the estuary, a larger temporal boundary than 2030 would have to be involved because these large scale processes operate on the long term.
3. It was thought that upscaling to the river basin would lead to an even higher level of aggregation. The policy analysts feared that the selection of the river basin scale would be at the expense of the depth of the study because of efficiency reasons. The political actors were also afraid that upscaling might lead to a higher level of aggregation because they thought that the quality of decision making would change when more actors were involved. They also thought that discussions would have to be simpler and more recognisable for a large group and that therefore an even higher level of aggregation would be needed.
4. It was observed that the use of a large temporal scale automatically led to a generally high level of aggregation. It could be concluded that the combination of both contributed to consensus building: the long term helped to overcome short-term differences and the high level of aggregation helped to prevent conflicts over the details. This also was in line with the morphologists' views because they are able to either take into account a lot of detail on the short term or conduct a very global study on the long term.
5. The combination of limited spatial boundaries and the high level of aggregation led to a limited number of actors being involved. Limiting the spatial boundaries led to a limited number of actors (for example Zeebrugge was excluded). This contributed to a willingness to cooperate and progress. Also, the high level of aggregation led to a limited number of actors (regional actors were excluded) which led to the limitation of a number of issues and finally to limited regional support for the study.
6. The large spatial scale led to limited commitment of the regional actors, as mentioned earlier in this chapter. The combination of the large spatial scale with the low level of aggregation, however, helped to secure the regional actors' commitment. The downside was that it also made it impossible to finish the project in time and within budget because the modelling became a huge endeavour.
7. When more solutions appeared to be present on a regional scale than on a national scale, the temporal boundaries were reduced as well. Options to resolve the water shortage problem were expected to be mainly local, so they could not be too pretentious.
8. It was noticed that regional actors do not often think 50 years ahead. For the national government, it was considered more natural to look at 2050. So, the temporal boundaries were also linked to the spatial scales of the options.

10.6. Reflection on the actors' roles

Policy analysts have to be aware of the role they play in the policy analysis process, as well as the roles of the other actors involved. Reflection on the roles of the actor archetypes based on the case studies led to some suggestions for policy analysts to be more aware of their own role in relation to the roles of the other actor archetypes.

Policy analysts

Policy analysts often want to make decisions explicit and to structure everything (as is also being done in this thesis). It is important to realise that this is not always wanted by the other actors involved. Despite their large responsibility in the study, the influence of policy analysts on (scale) choices made in policy analysis processes appears to be limited. If potential conflicts exist (spatial scale and time scale, LTV), they may intervene to prevent conflicts and to mediate for a solution that is satisfying for all actors involved. At other times, their opinion is ignored (disagreeing with the level of aggregation in the WSS). From the case studies, it can be concluded that the policy analysts felt they had sometimes insufficient power to make decisions. This put an extra challenge on them to play their role in a clever way by, for example, investing in the relationship with the commissioner and finding strategic allies.

In the LTV, the policy analysts initially argued with the commissioners against the selection of a limited spatial scale. Although they did not succeed on that matter, they played an important role in the making of scale choices as a mediator in this sensitive issue. In the entire LTV, the policy analysts maintained the director's role, although this role was not acknowledged by some of the actors. This was confirmed in interviews in which the views of the different actors involved in the role of the policy analysts differed very much: while some actors stated that their role contributed largely to the success of the study, others thought they played a very minor role. The role of policy analysts seems to be like oil in a machine: if a machine gets stuck: put oil in it. Most important is that the contribution of the policy analysts was recognised by the commissioners of the study (see also the section about the commissioners).

In the Water Shortage Study, the policy analysts proposed making a process model in order to understand the physical processes playing a role, but the researchers outnumbered them and ruled with their detailed model Moloch. Also, the analysts argued against the modelling efforts in the second phase of the study. The policy analysts would have liked a more autonomous role than they had in reality. In the WSS, they clearly did not have the director's role. The policy analysts thought that at the start of the study the researchers were too much in control and in the end the policy makers were. This resulted in a lack of balance in the project. The policy analysts had the feeling they were all alone in their disagreement with the low level of aggregation. However, during the interviews, it appeared that some other researchers had a similar opinion on the use of too much detail in the modelling at the start and on the importance of a process model to understand the relations first. The policy analysts, however, did not know of the presence of like-minded actors. This shows that it might help if policy analysts find strategic allies if they do not agree with certain (scale) decisions.

Not only at the start in the design of the study did the policy analysts play an important role regarding the scale choices. It can be concluded that the adjustment in scale choices often coincided with a change in the emphasis of the goal(s) of the study. Politics is chaos; things always go differently than expected, and it is regarded as difficult to set clear goals at the beginning of the study (Lindblom, 1959). This requires that policy analysts take a flexible approach and practice adaptive design. The lesson to be learned from this is that policy analysts have to be alert to goal shifts during the study and, when these occur, evaluate the prior design choices in light of the new goals. Also, it is important to take time for reflection during the process: Are we still doing things right? Are we still doing the right things?

Political actors
This research clearly shows that scale choices can be a strategic instrument that can be used for personal gain. Table 10.8 gave some examples of the strategic use of scale. The LTV showed that the political actors themselves were very conscious of strategic handling of scale choices by other actors, maybe sometimes even paranoid.

Suggestion for the policy analysts:
Although it is, for a large part, the responsibility of the political actors themselves to be aware of the possibility that other political actors might use scale as a strategic instrument, the policy analyst must also be aware of signs that scale choices may be used to strategically influence the study. Be aware of the roles of other actors involved: they might not play the role that is most apparent. They can provide insight into the strategic consequences of scale choices without choosing sides.

Commissioners
In the WSS, the policy analysts were hired by RIZA (the research institute of the Ministry) instead of by the Ministry itself. Although the project leader of RIZA was a very good policy analyst, the RIZA researchers involved outnumbered the other actors on the project team, so they were very dominating in this study. This gave the policy analysts little power to direct the process. The lesson that can be drawn from this is that the dependency of the policy analyst on the commissioner and the way the team is put together is big.

Suggestion for the policy analysts:
Policy analysts should define their role very carefully at the start of the study and discuss this with the commissioner of the study to jointly establish their added value. Construct, together with the commissioner, clear criteria to define when the study is thought to be successful and discuss who is responsible for what. Discuss those aspects again if the goals start to shift due to the dynamics of the process. Policy analysts have to become the commissioner's strategic partner: together with the commissioner, policy analysts are often the only ones with a clear, common interest in the study. The contribution of the policy analyst does not have to be visible for other actors in the process, as long as it is appreciated as such by the commissioner.

Researchers
Researchers who cooperate in policy analysis processes need to be capable of putting their discipline into perspective and look a little beyond the scope of their discipline. Researchers need to have a clear understanding of how boundaries, with all of their political, economic, social, cultural and scientific baggage, influence relations and dynamics. This information provides essential information for working closely with decision makers and stakeholders (Morehouse, 2003).

Researchers, especially, tend to focus quickly on the details of one aspect without seeing the big picture. It is important for them to realise for whom and for what purpose the study is being executed and how the knowledge that they contribute to this process will be used. It is also important to be aware of the needs of the decision-making process during the entire research and not lose oneself in the details of the content.

Suggestion for the policy analysts:
Policy analysts have an important task to clarify the needs of the decision-making process to the researchers involved. This can be a challenge, as was seen in the WSS. It requires

extensive two-way communication. Even better is the facilitation of an intensive direct dialogue between the political actors and the researchers involved in order to get a better mutual understanding: for the researchers - what is needed in the decision-making process; for the political actors - what is realistic. The policy analysts have to find a fine-tuned balance between the details of the research and the amount of attention for the discussion and the reflection. If a low level of aggregation is used by the researchers, this may not only cause a communication problem in the policy debate because people can not see the forest for the trees, also the attention and the resources may be distracted from the process of discussion and reflection. Here the managerial rationality of the policy analysts palys an important role as well.

10.7. Contribution of the research and suggestions for future research

Contribution of this research

This thesis makes a number of contributions to the field of policy analysis.
First, it shows the importance of scale choices to the field of policy analysis. Policy analysis results are sensitive to scale, therefore scale choices are a relevant and complex issue. The making and handling of scale choices involve many dilemmas and, if not consciously addressed, many pitfalls play a role.

Second, the thesis shows specific effects of scale choices on the content of the policy analysis, by the construction of system diagrams which give insight into the variables that are taken into account, the exogeneous factors and the options and on the process, by the construction of actor analysis diagrams that show what actors are included or excluded and whether they feel dedicated or are considered critical. These specific effects are where possible translated to framing guidelines that are usable in policy analysis design and help to think the consequences of scale choices through.

Third, the tool presented in this thesis to make scale choices a subject of discussion can also serve as a means for the policy analyst to address other fundamental issues that usually exist below the surface but are hardly ever out in the open such as differences in power, interests and hidden agendas. When discussing options for scale choices, a seemingly harmless and substantive subject, actors involved may be tempted to reveal a little more of their way of thinking and strategy.

Four archetypical views were identified: political actor, commissioner, analyst and researcher. Each had different preferences and used different arguments for their scale choices. The case studies have demonstrated that a structured analysis of their perspectives and interests can provide information for rational deliberation of the impacts of scale choices. This is thought to be useful for other design choices as well. It provides insight into the potential controversy over design choices and justifies paying extra attention to the process of making those choices.

Finally, the thesis also shows that using the policy analysis approach for policy analysis itself (i.e. performing a miniature policy analysis at the start of the policy analysis process) is very helpful. After all, when the stakes are high, it would seem only rational for those trained as analysts to perform an ‘impact assessment of design’ in the early stage of any policy analysis process. Therefore, this research also contributes to the quality of policy analysis design.

Suggestions for future research
Starting from the results of this research, some interesting directions for future research can be further explored:

- *Test the generic applicability of the framing guidelines in practice: are they applicable and effective?*
  The framing guidelines were developed by using two case studies, which is rather limited. The applicability and effectiveness of these guidelines have not been tested yet. This can be done by looking at a large number of studies that have been finished and perform a thought experiment to check all the guidelines. For example: If I would have used a larger spatial scale, would I have increased the number of issue trade-offs in this study? If the guidelines appear not to be generic, it is important to specify under what conditions they are valid. Also, when looking at other case studies, additional framing guidelines may be developed.

- *Test the recommendations (framework for design reflection) in an experimental setting.*
  One group can be asked to design a study and make scale choices when using the recommendations and another group can be asked to do the same thing but has to work without the recommendations in order to see the difference in the process that is followed and in the scale choices that result. This makes it possible to test the added value of using the recommendations. Care should be taken to select two groups that are rather comparable and do not differ a lot in experience in policy analysis, otherwise the effect of the recommendations is not measurable. This could be handled by using a group of students in the experimental setting. Two different conclusions can be drawn:
    - Is it usable?
    - Does it produce better results? Of course, 'better' is always a difficult notion, but in this case better can be defined as contributing to the objectives of the study.

- *Learn more about the foreseen/ unforeseen and intended/unintended effects of scale choices*
  This would again require a case study approach in which the actors are interviewed at the beginning of the policy analysis process and at the end. In this way, more can be learned by the use of scale choices as a framing instrument in current studies and about the knowledge of actors involved about the effects.

- *Test the applicability of this methodology in other fields than water management.*
  In many other fields, scale choices play an important role, for example in other interdisciplinary fields that have a close relation to the physical system such as climate change, spatial planning, integrated resources management and environmental impact assessment. It would be interesting to see whether the guidelines that are developed in this research are applicable in those areas as well. Also, it might be interesting to study whether the guidelines are also useful in interdisciplinary fields that are not related to the physical system. The scale related guidelines might be interesting for macro-economics and epidemiologic studies. This could be done by taking cases in those areas and study them in the same way that was done in this research.

10.8 Closing remarks

Personally, I hope that this thesis also contributes to a better understanding between political actors and researchers by giving some insight into the way different actors reason. I am very grateful that I had the opportunity to conduct so many interviews that provided me with a very multi-dimensional picture of all the actors that are operating in policy analysis processes. The literature cited in the various chapters already showed the existence of a tension field between politics and science, but also in practice I could regularly observe similar reactions. All too often I saw signs of disrespect in both worlds towards each other: researchers wanting to draw simple pictures because ‘otherwise policy makers would not understand’; policy makers talking about the ‘techneuten’ (Dutch name for technical people that is often used in a negative connotation by non-technical people, but is, strangely enough, often regarded as an epithet by technical people) who talk in too much useless details

Of course, it is true that the political world is different from the scientific world and that other values are important. A little more appreciation for each other’s qualities would already be an important step in the right direction. Policy makers need to realise that researchers cover their ‘blind spots’, a passion for the content and a long-term orientation. Policy makers also need to realise that feedback to researchers is important: What is done with their conclusions in the decision- making process? How is the research used? In this way the researchers gain a better understanding of the needs of the decision-making process.
Researchers, on the other hand, must be able to put their work into perspective and imagine for themselves the big picture, the context in which their work is used (Karstens and van Deen, 2007).

Also, starting a real dialogue to try to develop a better understanding of each other’s ways of thinking and showing interest in each other’s motivation might help to reduce the tension field that is felt by so many so often. We really need each other to make good policies.

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Appendix 1 Questionnaire quick scan

Handling scale issues in water management

Sonja Karstens, PhD student
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Delft University of Technology, PO Box 5015, 2600 GA Delft, The Netherlands
Email: sonjak@tbm.tudelft.nl

Scale in Water Management
Within water management a variety of spatial and temporal scales play a role; varing from river basin management (broad international) to drinking water supply (local detail). These issues ar different scales can also interact. In all studies in water management, implicitely or explicitly, a selection of scale is made: at what spatial scale are we going to study the problem: national or regional? What time scale do we use: long term or short term? Are we analysing the problem in detail or on a more abstract level?

Why is scale important?
The selection of scale has large consequences: it determines the kind of problems that are studied, the solutions to be found and the impact of effects. Scale, however, is not politically neutral: a selection of scale may privilege certain stakeholders: a small scale will put other isues and problems more prominently on the agenda that a large scale. Also people from different disciplines have different perspectives on scale: for a geologist long term has a very different meaning that for a spatial planner. Policy analysts need to make these issues transparent and reflect on the consequences of scale choices.

This PhD research….
Studies these scale issues and the dilemmas that play a role. The goal is to give recommendations to policy analysts to handle these issues in a responsible way.

To gain insight in your views on scale issues, the relation with your discipline and how scale issues affect your work I kindly request you to complete the questionnaire form attaced to this paper. Thank you very much!

YOUR VIEWS ON SCALE ISSUES

1. Your disciplinary background
   Characteristic spatial scale(s) in your discipline: ……………………….
   Characteristic temporal scale(s) in your discipline: ……………………..
   Units of analysis often used in your discipline: …………………………
2. Your job description:…………………………………………………………
3. How would you define the term "scale issues"?
   ……………………………………………………………………………
   ……………………………………………………………………………
   ……………………………………………………………………………
4. Which scale issue(s) do you consider to be important?
   - ○ Selection of scale (extent)
   - ○ Selection of level of aggregation (amount of detail)
   - ○ Dealing with cross-scale interactions (interactions between scales)
   - ○ Dealing with scaling issues (transfer of scale)
5. Do scale issues play a role in your work? How? Can you give an example?
   ……………………………………………………………………………
   ……………………………………………………………………………
   ……………………………………………………………………………
6. What are criteria that you use for the selection of scale when you study a problem?
   ……………………………………………………………………………
   ……………………………………………………………………………
   ……………………………………………………………………………
7. What are the important consequences of a certain selection of scale?
   ……………………………………………………………………………
   ……………………………………………………………………………
   ……………………………………………………………………………
8. Other remarks
   ……………………………………………………………………………
   ……………………………………………………………………………
   ……………………………………………………………………………

You can return the form in the inbox at my poster (workshop 4) or to me personally. Thank you very much for your co-operation!

○ Are you interest in receiving more information on this subject?
○ Are you willing to discuss this topic by email?
Please fill in your email address: …………………………………………………

Appendix 2 Policy analysts interviewed in the quick scan

Policy analysts interviewed on their view of scale choices at the start of the research (including affiliation at the time of interview)

- Prof. W.Walker- RAND Europe/ Delft University of Technology, Section of Policy analysis
- Dr. ir. O. van 't Riet- RAND Europe/ Delft University of Technology, Section of Policy analysis
- Ir. H. van der Most- WL Delft Hydraulics
- Drs. Ing. Fon ten Thij – Fon ten Thij Process Management
- Ir. H.A. Zanting- Resource Analysis/ ARCADIS
- Ir. H. van Waveren – Ministry of Transport and Water Management

Appendix 3 Actors interviewed in the case studies

Interviewed actors in case studies are mentioned in alphabetical order (including affiliation at the time of interview).

Long-Term Vision of the Scheldt Estuary

Drs. J. Blomme, Port of Antwerp
Ir. W.P.A. Broeders, Ministry of Transport and Water Management, Directorate Zeeland and Technical Scheldt Commission
Ir. J. Claessens, Ministry AWZ
Drs. C.J. Colijn, Province of Zeeland
Ir. J. Coosen, Ministry of Transport and Water Management, Directorate Zeeland
Drs. S. Van Damme, University of Antwerp, Department of Ecosystem Science
Ir. M. van Dijk, Resource Analysis Antwerp
Drs. J. Van Hoof, Ministry AWZ, Flanders
Dr. G. De Monie, Policy Research Corporation, Antwerp
Drs. Ing. A.C. ten Thij, Resource Analysis Delft
Dr. J.H. Slinger, Resource Analysis Delft
Dr. J.C. Winterwerp, WL Delft Hydraulics
Ir. H.A. Zanting, Resource Analysis Delft

Water Shortage Study

Ir. W. Aarnink, Ministry of Agriculture, Nature and Food Quality
Prof.ir. E. van Beek, Deltares
Drs. C. van Bladeren, Union of Waterboards
Ir. S. van Dijk, Ministry of Transport and Water Management, DG Water
Ir. L.J. Dijkhuis, Ministry of Transport and Water Management, DG Water
Drs. R.van Ek, RIZA
Drs. A. Gongrijp, RWS Zuid-Holland
Dr.ir. M. de Groen, Resource Analysis/ ARCADIS
Drs. M. Hilders, VNG (Dutch Municipalities)
Drs. J. Kind, RIZA
Ir. T. Kroon, RIZA
Ir. Ir. H. van Waveren, RIZA
Ir. R. Versteegh, HKV lijn in water
Ir. H.A. Zanting, Resource Analysis/ ARCADIS

Appendix 4 Question list used as a basis for the interviews

I. General
- Which objective of study did you consider to be most important? Why?
- What kind of role did you have in the study? (KA: position, effort, involved in the content)
- What was your (personal) interest in this study?

II. Thought experiment
- Are alternatives I used for the thought experiment plausible? Would you have selected other alternatives? If yes, which ones and why?
- What do you consider arguments in favour of and against each alternative?
- What if these scale choices were made: what consequences would you expect? How would you value these consequences?

III. Preferred scale alternative
- What was your preferred scale option for this study? (spatial scale, time scale, level of aggregation, level of actors involved) Why?
- Is it difficult to determine your preferred scale option? If yes, which dilemmas did you perceive in your preference? What trade-offs?
- What criteria do you use to determine your preference?
- How do you think your preferred scale choices would have contributed to the achievement of the objectives of study you consider important?

IV. Process: Making scale choices
- How did the scale choice emerge? (negotiation/ commissioners order/ actors demand). Did the making of the scale choices raise a lot of discussion? If yes, why?
- Who decided on the actual scale choices?
- Which (other) actors did influence the scale choices? How?
- What was your own influence on the scale choices actually made?
- What arguments/ criteria played a role in the scale choices actually made? Were these criteria made explicit before the decision was taken or is it used as an argument later in the process? What was your own perception of criteria playing an important role? Were scale choices made in a transparent way?
- Which dilemmas were present in making the actual scale choice?
- Which scale choice do you think was the most determining for the outcome of the project? (time scale, spatial scale, level of aggregation).

V. Process: Handling scale choices
- Are adjustments in scale choices made in the policy analysis process itself?
- What kind of adjustments were made? When?
- How were adjustments made? (A: Occasional changes within the study? New study/ Additional study?)
- Who initiated the change of the scale choices?
- What were driving forces for the adjustment of scale choices?
- What was your opinion about the adjustments made? Why? What criteria do you use to evaluate adjustments?

VI. Outcomes
- Which consequences of the scale choices did you observe?
- How happy were you with the actual scale choices made? Why (not)? (Use statements)
- Do you think that the objectives of study were achieved?

Appendix 5 Score cards for the spatial boundary setting

Table A.5.1: Score card for the spatial boundary setting in the LTV (Political actor)

Political actor	Criteria	Scheldt River Basin	SE incl Tributary rivers	SE incl Zeebrugge	SE incl CGT	SE excl tributary rivers	Western Scheldt
In favour of deepening	Coherence of issues	↓ -	0	0	↓ -	0	0
	Relevance	0	↓ -	0	0	0	0
	Economic relevance	0	0	↑ +	0	0	0
	Justifiability	0	↓ -	0	0	0	0
	Action ability	0	0	↓ -	0	0	0
	Protection of interests	0	0	↓ -	0	0	0
	Efficiency	0	0	↓ -	0	0	0
	Systems completeness	0	0	↑ +	0	0	0
	Coherence of issues	0	0	0	0	↑ +	0
	Number of issues addressed	0	0	0	0	↑ -	0
	Focus on the agenda	0	0	0	0	0	↑ +
	Clarity of the problem	0	0	0	0	0	↑ +
	Balance between actors involved	0	0	0	0	0	↓ -
Against deepening	Systems completeness	↑ +	0	0	0	0	↓ -
	Inclusion of issues	↑ +	↑ +	0	0	0	0
	Number of actors involved	↑ -	↑ -	0	0	0	0
	Overlap with other arenas/ treaties	↑ -	0	0	0	0	↑ -
	Complexity	↑ -	0	0	0	0	0
	Quality of decision making	0	↓ -	0	0	0	0
	Possibilities for alternative solutions	0	0	↑ +	0	0	0
	Political sensitivity	0	0	↑ +	0	0	0
	Protection of interests	0	0	↑ +	0	↓ -	0
	Possibilities for issue trade-offs	0	0	0	↑ +	0	0
	Political sensitivity	0	0	0	↑ +	0	0
	Inclusion of important actors	0	0	0	0	0	↓ -
Neutral	Number of nations involved	↑ -	0	0	0	0	0
	Time needed for the study	↑ -	0	0	0	0	0
	Number of actors involved	↑ -	0	0	0	0	0
	Number of issues addressed	↑ -	0	0	0	0	0
	Possibilities for consensus building	↓ -	0	0	0	0	0
	Quality of decision making	↓ -	0	0	0	0	0
	Political sensitivity	↑ -	0	0	0	0	0
	Overlap with other arenas/ treaties	↑ -	0	0	0	0	0
	Inclusion of issues	0	↑ +	0	0	0	0
	Possibilities for issue linkage	0	↑ +	0	0	0	0
	Relevance for actors involved	0	↓ -	0	0	0	0
	Inclusion of issues	0	↓ -	0	0	0	0
	Coherence of issues	0	↓ -	0	0	0	0
	Autonomy of nations		↓ -	0	0	0	0
	Willingness of actors to get involved	0	0	↓ -	0	0	0
	Solvability of the problem	0	0	Not larger, -	0	0	0
	Justifiability	0	0	0	+	0	↓ -
	Coherence of issues	0	0	0	↓ -	0	0
	Fit with other legal frameworks	0	0	0	0	↑ +	0
	Systems completeness	0	0	0	0	↑ +	↓ -
	Balance between actors involved	0	0	0	0	0	↓ -

Table A.5.2: Score card for the spatial boundary setting in the LTV (Commissioner of the study)

Criteria	Scheldt River Basin	SE incl Tributary rivers	SE incl Zeebrugge	SE incl CGT	SE excl tributary rivers	Western Scheldt
Coherence in options	↑ +	0	0	0	0	0
Systems completeness	↑ +	0	0	0	0	↓ -
Inclusion of issues	↑ +	↑ +	0	0	0	0
Fit with other frameworks	↑ +	0	0	0	0	0
Number of nations involved	↑ -	0	0	0	0	0
Number of actors involved	↑ -	0	0	0	0	0
Number of languages	↑ -	0	0	0	0	0
Possibilities for consensus building	↓ -	0	0	0	0	0
Time needed for the study	↑ -	0	0	↑ -	0	0
Complexity	↑ -	0	0	↑ -	0	0
Overlap with other arenas/ treaties	↑ -	0	0	0	0	0
Focus on the agenda	↓ -	0	0	↓ -	↑ +	0
Number of issues	0	↑ -	0	0	0	0
Relevance for actors involved	0	↓ -	0	0	0	0
Legal validity	0	0	↑ +	0	0	0
Coherence of issues	0	0	↑ +	0	↑ +	0
Protection of interests	0	0	↑ +	0	0	0
Political sensitivity	0	0	↑ -	0	0	0
Justifiability	0	0	0		0	0
Economic relevance	0	0	0	↑ +	0	0
Decision making ability	0	0	0	↓ -	0	0
Feasibility	0	0	0	0	↑ +	0
Practical workability	0	0	0	0	↑ +	
Common interest of actors involved	0	0	0	0	0	↓ -
Balance between actors involved	0	0	0	0	0	↓ -
Coordination burden	↑ -	0	0	0	0	↑ -

Table A.5.3: Score card for the spatial boundary setting in the LTV (Policy analyst)

Criteria	Scheldt River Basin	SE incl Tributary rivers	SE incl Zeebrugge	SE incl CGT	SE excl tributary rivers	Western Scheldt
Fit with other legal frameworks	↑ +	0	0	0	0	0
Inclusion of issues	↑ +	0	0	0	0	0
Systems completeness	↑ +	↑ +	0	↓ -	↓ -	0
Number of nations involved	↑ -	0	0	0	0	0
Complexity	↑ -	0	↑ -	0	0	0
Number of actors involved	↑ -	↑ -	0	0	0	0
Coherence of issues	↓ -	↓ -	↓ -	0	0	0
Overlap with other arenas/ treaties	↑ -	0	0	0	0	0
Time needed for the study	↑ -	0	0	0	0	0
Relevance for actors involved	↓ -	0	0	0	0	0
Focus on the agenda	↓ -	0	↓ -	↓ -	0	0
Justifiability	↑+	↑+	↑+	↑+	0	0
Number of options	0	↑ +	↑ +	0	0	0
Interference with other plans	0	↑ -	0	0	0	0
Possibilities to line up with other plans	0	↑ +		0	0	0
Autonomy of nations	0	↓ -	↓ -	0	0	0
Match with level of authority of the commissioner of the study	0	↓ -		0	0	0
Relevance for the decision making	0	0	↓ -	0	0	0
Relevance	0		0	↑ +	0	0
Governmental coherence (one initiator)	0	0	0	0	↑ +	0
Progress	0	0	0	0	↑ +	0
Quality of the study	0	0	0	0	↓ -	0
Solvability of the problem	0	0	0	0	↓ -	0
Uniformity/ synchronism of policy	0	0	0	0	↓ -	0

Table A.5.4: Score card for the spatial boundary setting in the LTV (Researcher)

Discipline of researcher	Criteria	Scheldt River Basin	SE incl Tributary rivers	SE incl Zeebrugge	SE incl CGT*	SE excl tributary rivers	Western Scheldt
Morphology	Systems completeness	system is already complete -	0	0	0	0	↓ -
	Validity of the study	0	0	↑ +	0	↓ -	↓ -
	Complexity	0	0	↑ -	0	0	0
Economy	(Economic) relevance	↓ -	↓ -	0	0	0	0
	Justifiability	0	0	↓ -	0	0	0
	Complexity	0	0	0	↑ -	0	0
	Decision-making ability	0	0	0	↓ -	0	0
	Systems completeness	0	0	0	0	↑ +	↓ -
	Disputability of the study	0	0	0	0	0	↑ -
Ecology	Systems completeness	↑ +	0	0	↑ +	↓ -	↓ -
	Possibilities for model building	↑ +	0	0	0	0	0
	Feasibility	↓ -	0	0	0	0	0
	Quality of the study	0	↑ +	0	0	0	0
	Complexity	0	↑ -	0	↑ -	0	0
	Justifiability	0	0	↓ -	0	0	0
	Comprehensiveness	0	0	0	0	↑ +	0
	Clarity of boundaries and boundary conditions	0	0	0	0	↑ +	0
	Number of scientific actors involved	0	0	0	0	↓ +	0
	Inclusion of available knowledge	0	0	0	0	0	↓ -

** this alternative was not discussed with the morphologist*

Table A.5.5: Score card for the spatial boundary setting in the WSS

Actor archetype	Criterion	River Basin	The Netherlands	Region
National political actor	Inclusion of issues (temperature of the water)	↑+	0	0
	Complexity	↑-	0	0
	Relevance	↓-	↑+	0
	Political sensitivity	↑-	0	0
	Ability to manage	↓-	0	0
	Dedication of regional actors	0	↓-	0
	Justifiability	0	↑+	0
	Inclusion of issues	0	↑+	0
	Fit with WB21	0	↑+	0
	Ability to locate the problems	0	0	↑+
Regional political actor	Knowledge availability/ research manpower	0	↑+	0
	Dedication of regional actors	0	↓-	0
	Insight in key parameter (national water distribution)	0	↑+	0
	Interest for the actors involved	0	↓-	0
	Insight in relation main water system-regional water system	0	↑+	0
	Awareness raising	0	↑+	0
Commissioner	Focus on the agenda	↓-	0	0
	Possibility to schedule the problem	↓-	0	↓-
	Match with level of authority	0	↑+	0
	Action orientation	↓-	0	↓-
	Flexibility	0	↑+	0
	Clarity of the problem	0	↑+	0
	Insight into the system	0	0	↑+
	Understanding the interdependencies	0	↑+	0
	Solvability of the problem	↑+	↑+	0
	Match with other issues (water flooding also studied on that scale)	↑+	0	0
	Commitment	↓-	0	0
	Dependence	↑-	0	0
	Presence of options with large effects	0	↑+	0
	Involvement of issues (climate change)	0	0	↓-
	Possibilities to shift the problem to another scale	0	0	↑-
Policy analyst	Complexity	↑-	0	0
	Time frame of the study	↑-	*0*	*0*
	Feasibility	↓-	0	0
	Resistance of actors involved	↑-	0	0
	Model availability	0	↑+	0
	Coherence of measures	0	↑+	↓-
Hydrologist	Availability of options	0	0	↑+
	Exploration of options	↑+	0	0
	Dependency from upstream countries	↑-	↓+	0
	Uniformity for regional studies	0	↑+	0
	Model availability	0	↑+	0
	Shift ability of the problem	0	0	↑-
	Insight into key parameter (national water distribution)	0	↑+	0
	Inclusion of issue of cooling water	↑+	0	0
Ecologist	Availability of models	0	↑+	0
Economist	Fine tuning possibilities	0	0	↑+
	Possibilities for uniformity	0	↑+	0
	Possibilities for overall economic optimisation	0	↑+	0

↓ factor decreases, ↑ factor increases, + valued positively by the actor, - valued negatively by the actor, 0: no change mentioned

Appendix 6 Score cards for the temporal boundary setting

Table A.6.1 : Score card for the temporal boundary setting in the LTV

Actor archetype	Criterion	2010	2030	2050
Political actor in favour of deepening	Economic relevance	↑+	0	0
	Match with objectives of study	0	↑+	0
	Match with phase of the process	↑+	0	0
	Possibility to address the underlying problems	↑+	0	0
	Prediction possibilities for economics	0	↓-	↓-
	Prediction possibilities for ecology	0	↑+	↑+
	Sense of urgency	↑+	0	0
	Validity of the study	0	↓-	↓-
	Protection of interest	↑+	0	0
Political actor against deepening	Oversee ability	↑+	0	0
	Possibilities for consensus building	↓-	↑+	↑+
	Sense of urgency	0	0	↓-
	Validity of the study	0	↓-	↓-
Neutral political actor	Justifiability	0	↑+	0
	Match with other similar projects	0	↑+	0
	Match with economic processes	↑+	0	0
	Match with morphological processes	↓-	0	0
	Validity of the study	0	0	↓-
Commissioner	Action ability	0	0	↓-
	Balance between different elements	0	↑+	0
	Broadness of options	↓-	0	0
	Creativity	0	0	↑+
	Match with other similar projects	0	0	↑+
	Match with phase of the process	↓-	0	0
	Possibilities for consensus building	↓-	↑+	0
	Possibilities to fulfill ambition	↓-	0	0
	Realisation possibilities of solutions	↓-	0	0
	Safety relevance	0	0	↑+
	Sense of urgency	0	0	↓-
	Validity of the study	0	0	↓-
	Visibility of effects	0	↑+	0
Policy analyst	Action ability	↑+	0	0
	Broadness of options	↓-	0	0
	Coherence of options	↓-	0	0
	Governmental relevance	0	↑+	0
	Justifiability	0	↑+	0
	Match with objectives of study	↓-	0	0
	Match with other similar projects	0	↑+	0
	Number of options	↓-	0	0
	Sense of urgency	↑+	0	0
	Validity of the study	0	0	↓-
	Surveyability	0	↑+	0
	Feasibility	0	↑+	0
	Realism	0	↑+	0
Morphologist	Match between spatial scale and time scale	0	↓-	↑+
	Match with large scale morphological processes	-	0	0
	Possibilities for model building	↑+	0	↑+
	Possibilities to verify predictions	↑+	0	0
Economist	Availability of data	0	↓-	0
	Decision making ability	0	0	↓-
	Match with economic processes	↑+	0	0
	Possibilities to calculate return on investment	↓-	↑+	0
	Prediction possibilities	0	0	↓-

↓ factor decreases, ↑ factor increases, + valued positively by the actor, - valued negatively by the actor, 0: no change mentioned

NB No score card could be constructed for the ecologist because the ecologists disregarded using temporal boundaries entirely.

Table A.6.2 : Score card for the temporal boundary setting in the WSS

Actor archetype	Criterion	2015	2050
National political actor	Match with other policies	↑+	0
	Inclusion of issues	↓-	↑+
	Match with available other research	0	↑+
	Match with planning term of infrastructure	0	↑+
Regional political actor	Match with large scale measures	0	↑+
	Match with other policies	↑+	0
	Inclusion of issues	0	↑+
	Complexity	0	↑-
Commissioner	Match with other policies	↑+	0
	Inclusion of issues	0	↑+
	Action ability	0	↓-
	Match with the discount rate	0	↑+
	Sense of urgency	0	↓-
	Match with daily practice	↑+	0
	Overseeability	↑+	0
	Risk of shift of problem into the future	0	↑-
Policy analyst	Match with spatial scale of options	↑+	0
	Possibilities to take uncertainty into account	0	↑+
	Robustness of options	0	↑+
	Match with requested temporal level of aggregation	↑+	↓-
	Match with other policies (WB 21)	0	↑+
	Match with climate change issue	0	↑+
Hydrologist	Match with other policies	↑+	0
	Match with return on investment	0	↑+
	Model reliability	0	↓-
	Possibilities to take into account uncertainties	0	↑+
Ecologist	Quality of the modelling results	0	↓-
	Match with nature management developments	0	↓-
Economist	Possibilities to calculate return on investment	0	↑+
	Possibilities to take into account regret of options	0	↑+
	Match with realisation possibilities of large scale measures	0	↑+
	Match with term of river basin plans	↑+	0
	Match with other adjacent project	↑+	0

↓ factor decreases, ↑ factor increases, + valued positively by the actor, - valued negatively by the actor, 0: no change mentioned

Appendix 7 Score cards for the selection of the level of aggregation

Table A.7.1: Score card for the selection of the level of aggregation in the LTV

Actor archetype	Criterion	High level of aggregation	Low level of aggregation
Political actor	Match with large influence on the problem	0	↑+
	Match with important or urgent problems	0	↑+
	Match with non important or non urgent problems	↑+	0
	Recognisability for actors with their own concrete policy issues	0	↑+
	Time efficiency	↑+	0
Commissioner	Time efficiency	↑+	0
	Match with presence of adjacent research projects	↑+	0
	Match with high political sensitivity	↑+	0
	Match with large influence on the problem	0	↑+
	Match with availability of al lot of detailed data	0	↑+
	Match with availability of limited detailed data	↑+	0
Policy analyst	Time efficiency	↑+	0
	Possibilities for consensus building	↑+	0
	Match with presence of adjacent research projects	↑+	0
	Need for cooperation	↑+	0
	Handling of disputability of knowledge in the team of experts	0	↑+
	Match with high urgency of the problem	0	↑+
	Recoginsability (own concrete policy issues)	0	↑+
	Match with availability of al lot of detailed data	0	↑+
	Match with availability of limited detailed data	↑+	0
	fit with the vision building	↑+	0
Researcher	Time efficiency	↑+	0
	Visibility of the big line/ integrated approach	↑+	0
	Scientific validity	0	↑+
	Match with availability of al lot of detailed data	0	↑+
	Match with availability of limited detailed data	↑+	0
	Match with high uncertainty	↑+	0

↓ factor decreases, ↑ factor increases, + valued positively by the actor, - valued negatively by the actor, 0: no change mentioned

Table A.7.2: Score card for the selection of the level of aggregation in the WSS (Modelling scale)

Actor archetype	**Criterion**	**Low level of aggregation**	**High level of aggregation**	**Differentiated level of aggregation**
National political actor	Possibility to judge the reliability of the results	0	0	↓-
	Match with expensive measures	↑+	0	0
	Scheduling possibilities	0	↑+	0
Regional political actor	Possibilities to judge the reliability of the results	↑+	0	0
	Commitment of regional actors	↑+	0	0
*Commissioner**	-			
Policy analyst	Unjustified feeling of security	↑-	0	0
	Balance in the project	0	0	↓-
	Match with non-solvable problems	0	↑+	0
	Match with solvable problems	↑+	0	0
	Match with interesting issues	↑+	0	0
	Match with non interesting issues	0	↑+	0
Hydrologist	Unjustified trust in the models	↑-	0	0
	Match with data availability	↑+	0	0
	Flexibility	↓-	0	0
Ecologist	Match with availability of detailed data	↑+	0	0
	Match with limited attention	0	↑+	0
	Validation possibilities	↑+	0	0
	Communication possibilities	↑+	0	0
	Transparency	↑+	0	0
*Economist***	-			

↓ factor decreases, ↑ factor increases, + valued positively by the actor, - valued negatively by the actor, 0: no change mentioned

* The commissioners of the study did have no specific comments on the level of aggregation of the modelling studies. They did make some general remarks:

> *We did not interfere with the modelling itself. In my opinion that is something that can be decided by the researchers. Every alternative for the level of aggregation has some advantages and some disadvantages. As long as they keep the decision that has to be made based on the models in mind I think they have their own freedom.*
>
> *Another important aspect that has to be taken into account is on which agenda you want the issue to appear. The next question is how to get it there. The level of aggregation of the modelling can play a role in that matter.*

** The economist does not want to comment on the selection of the level of aggregation in the modelling. He explained:

> *It is difficult for me to comment on the level of aggregation. In economics the level of aggregation is the highest of all. In a cost-benefit analysis you throw everything together and come up with one specific number and maybe some additional costs. Of course, this number can also be provided for the different sectors or for the regions.*

Table A.7.3 : Score card for the selection of the level of aggregation in the WSS (Presentation scale)

Actor archetype	**Criterion**	**District**	**WB21**	**EFWD**
National political actor	Relevance (National study only the big picture is important)	0	0	↑+
	Match with governmental responsibilities	0	0	↑+
	Ability to distinguish	0	↑+	0
	Match with level of authority water boards	0	↑+	0
	Match with WB21 (water quantity)	0	↑+	0
	Recognisability for municipailites	↑+	0	0
	Action ability	↓-	0	0
	Match with level of authority	↓-	0	0
	Level of interest	↓-	0	0
	Level of appeal	0	↑+	↑+
	Effectiveness	0	↑+	↑+
Regional political actor	Recognisabililty	↑+	0	↓-
	Action ability for regional actors	↑+	0	↓-
	Match with system under study	0	0	↓-
	Good to match with other policies	0	↑+	0
	Match with WB21	0	↑+	0
	Insight in complexity problem	0	↑+	0
	Prevention of criticism	0	↓-	↓-
	Action ability water boards	0	↓-	0
	Validation possibilities of the quality of the results.	↑+	0	0
	Usability	↑+	0	0
	Overseeability for the regions	↑+	0	0
Commissioner	Match with the political agenda	0	↑+	↑+
	Recognisabillty	0	0	↑+
Policy analyst	Match with WB21 (the framework under which the Water Shortage Study is performed)	0	↑+	0
	Commitment of regional actors	↑+	0	0
	Multifunctional usability	0	↑+	0
	Recognizabillty	↑+	0	0
Hydrologist	Possibilities to present reliable results	0	0	↑+
	Uniformity of problems within units	0	0	↑+
	Rivers flow in the middle of the region so you can attribute the water shortage of shipping to a region	0	0	↑+
	Relevance (National study only the big picture is important)	0	0	↑+
	Match with river basin plans	0	0	↑+
	Recognition of the areas	0	0	↓-
	Recognisability of problems for regional actors	↑+	0	0
	Reliability of the model presentation	↓-	↑+	0
	Political sensitivity		↑-	0
	Match with intended focus of discussion (would focus on regional differences)	0	↓-	0
	Clear modelling unit, based on hydrological entities	0	0	0
	Districts are determined together with the water boards, has support	0	0	0
	Mistakes only become visible if you start zooming in	0		0
	Sovereign regions (have to have freedom to determine their own options, you do not want to sit on their chair)	↓-	0	0
Ecologist	Match with political interest	0	↑+	↑+
	Usefulness of the results	0	0	↑+
	Match with river basin plans	0	0	↑+
	Match with PAWN results	↑+	0	0
	Match with hydrological base	↑+	0	0
	Justifiability	↑+	↓-	↑+
Economist	Recognisability for the target group	↑+	0	0
	Regional support for the study	↑+	0	0
	Possibilities to check results	↑+	0	0

↓ factor decreases, ↑ factor increases, + valued positively by the actor, - valued negatively by the actor, 0: no change mentioned

Nederlandse samenvatting

Grenzen overbruggen: het maken van schaalkeuzes in multi-actor beleidsanalyse op het gebied van water management

1. Probleem, doelstellingen en onderzoeksaanpak

Processen in watermanagement spelen op verschillen schalen, zowel in ruimte als in tijd. Ruimtelijke schalen variëren van een globale schaal, waar processen als veranderingen in neerslag en evaporatie als gevolg van klimaatverandering optreden, tot lokale schaal, zoals de waterbalans in een stedelijk gebied. Deze schalen kunnen niet los van elkaar gezien worden aangezien tussen de schalen interacties optreden. Tijdschalen variëren van vele jaren voor langzame procesen zoals diffusie en dispersie van verontreinigingen in grondwater tot een aantal dagen voor hoog/dynamische processen als de rivierafvoer naar zee. Omdat er zo´n grote varieteit in schaalniveau´s bestaat, zijn er veel actoren op verschillende schaalniveau´s betrokken bij watermanagement, zoals stroomgebiedsbeheerorganisaties, nationale overheden, regionale overheden, gemeenten en waterschappen.

Beleidsprocessen op het gebied van watermanagement kunnen worden ondersteund door beleidsanalysten. Zij kunnen het beleidsproces ondersteunen door het verzamelen, integreren en structureren van informatie en door een debat tussen verschillende belanghebbenden te faciliteren. In het ontwerp van ieder beleidsanalyseproces moeten grenzen worden bepaald in ruimte en tijd. Ook moet bepaald worden welk detailniveau wordt gebruikt. Deze keuzes worden ook schaalkeuzes genoemd. Voorbeelden van belangrijke schaalgerelateerde vragen zijn: op welk schaalniveau gaan de problemen worden gedefinieerd en bestudeerd? Op welk schaalniveau gaan opties worden ontworpen? Op welk schaalniveau gaan effecten worden bestudeerd en worden de resultaten gepresenteerd?
Omdat watermanagementvraagstukken op zulke diverse ruimtelijke en tijdsschaalniveau´s spelen bestaan er vaak vele alternatieven voor de schaalkeuze wat bijdraagt aan de complexiteit van het keuzeproces.

Het maken van schaalkeuzes is ook complex door het gebrek aan uniformiteit in de gebruikte terminologie, de aanwezigheid van verschillende perspectieven en het gebrek aan inzicht in effecten. In een beleidsanalyseproces zijn schaalkeuzes zeer belangrijk omdat de keuze voor een bepaalde schaal mede bepaalt welke problemen onderzocht gaan worden en welke buiten de scoop vallen, welke oplossingen gevonden worden en welke buiten de scoop vallen en welke effecten geëvalueerd worden en welke niet. Schaal is niet politiek neutraal. Schaalkeuzes hebben een strategische waarde, omdat de schaalkeuze, bedoeld of onbedoeld, bepaalde belanghebbenden kan bevoordelen ten koste van anderen.

De ideale schaal bestaat niet, omdat alle mogelijkheden voor schaalkeuze voor en nadelen hebben, niet alleen voor de betrokken belanghebbenden maar ook op een meer generiek projectniveau. Daardoor gaan schaalkeuzes vaak gepaard met dilemma´s en moeten lastige afwegingen gemaakt worden.

Ondanks het feit dat het maken van schaalkeuzes lastig is en grote consequenties heeft, is er weinig theorie beschikbaar en zijn er geen richtlijnen hoe schaalkeuzes gemaakt moeten worden en hoe er mee omgegaan moet worden in beleidsanalyse. In dit onderzoek wordt een duidelijk verschil gemaakt tussen het maken en het omgaan met schaalkeuzes. Het maken van schaalkeuzes wordt gedefinieerd als het beslisproces dat leidt tot de schaalkeuze terwijl het omgaan met schaalkeuzes wordt gedefinieerd als hoe er met de schaalkeuze wordt omgegaan in het beleidsanalyseproces nadat de schaalkeuze is gemaakt. Wordt de schaalkeuze nog bijgesteld, genegeerd, strict of juist op flexibele wijze gehanteerd?

Uit deze probleemanalyse volgen twee doelstellingen voor dit onderzoek:

1. Inzicht geven in de rol van schaalkeuzes (ruimtelijke afbakening, tidshorizonbegrenzing en keuze van aggregatieniveau) in beleidsanalyseprocessen op het gebied van watermanagement
2. Richtlijnen geven en aanbevelingen doen voor het maken van schaalkeuzes in het ontwerp van beleidsanalyseprocessen. Deze richtlijnen en aanbevelingen moeten bijdragen aan het succes van het beleidsanalyseproces.

Omdat weinig bekend is over maken en omgaan met schaalkeuzes in theorie en praktijk heeft dit onderzoek een verkennend karakter. Het eerste deel bestaat uit een literatuurstudie waarin ook een conceptueel raamwerk van belangrijke aspecten wordt ontwikkeld. De literatuurstudie geeft tevens inzicht in de rationaliteiten die een rol spelen bij het bestuderen van schaalkeuzes en helpen het probleem van het maken van schaalkeuzes te structureren.
Het tweede deel van het onderzoek bestaat uit twee casussen waarin het maken van en het omgaan met schaalkeuzes in de praktijk is bestudeerd door middel van interviews met betrokkenen, observatie van het proces en analyse van projectdocumenten en aanverwante literatuur.

2. Rationaliteiten en schaal in beleidsanalyse

Dit onderzoek erkent de multi-actor context van beleidsanalyse. Dit wordt gedaan zonder het rationele, doelgerichte en analytische karakter van beleidsanalyse te ontkennen en de dilemma's die volgen uit de aanwezigheid van meerdere doelen en concurrerende waarden.
In deze studie worden vier rationaliteiten in beleidsanalyse onderscheiden die behulpzaam zijn in het analyseren van schaalkeuzes en hun effecten:

- Wetenschappelijke rationaliteit
- Politieke rationaliteit
- Management rationaliteit
- Ontwerprationaliteit

Deze rationaliteiten verschillen niet alleen in hun perspectief op beleidsanalyse maar ook in de manier waarop naar schaalkeuzes gekeken wordt.
In de *wetenschappelijke rationaliteit* spelen de karakteristieken van het systeem dat bestudeerd wordt een belangrijke rol, met name in disciplines die gerelateerd zijn aan het fysieke systeem. In verschillende disciplines bestaan er verschillende zienswijzen op schaal. Een geoloog, bijvoorbeeld, kijkt van nature naar een veel langere tijdschaal dan een econoom doordat geologische en economische processen op een heel andere tijdschaal spelen. Vanuit dit perspectief worden schaalkeuzes vaak niet gezien als vrij te maken keuzes maar gerelateerd aan een systeemkarakteristiek: de systeemschaal. Fysieke, sociale, politieke en economische systemen hebben allemaal karakteristieke ruimtelijke en temporele schalen. Aangezien deze schalen behoorlijk variëren, bestaan er vanuit de verschillende wetenschappelijke disciplines verschillende meningen over wat de geschikte systeemschaal is.
In de *politieke rationaliteit* worden schaalkeuzes beschouwd als een sociaal construct. Sociale constructen zijn menselijke keuzes, in tegenstelling tot wetten die door de natuur opgelegd

zijn. Schaalkeuzes worden daarbij vaak gezien als een instrument dat kan helpen om iemands doelen te realiseren. Schaalkeuzes kunnen niet alleen wat betreft de inhoud ervoor zorgen dat aspecten meegenomen of uitgesloten worden, ook de betrokkenheid van actoren is afhankelijk van het schaalniveau. Nieuwe actoren kunnen het proces betreden terwijl anderen het speelveld verlaten als voor een ander schaalniveau gekozen wordt. In de politieke rationaliteit kunnen belangen van verschillende actoren worden onderscheiden, hetgeen resulteert in verschillende zienswijzen op schaal.
In de *management rationaliteit* spelen praktische beperkingen zoals de beschikbare tijd en het beschikbare budget een belangrijke rol en kunnen het aantal haalbare alternatieven voor de schaalkeuze beperken. In deze rationaliteit wordt schaal beschouwd als een instrument dat gebruikt kan worden om het project te begrenzen en te bepalen welke aspecten wel en welke niet betrokken worden. Om een beleidsanalyseproces binnen de gestelde tijd en het gestelde budget te kunnen afronden is het noodzakelijk een balans te vinden tussen de begrenzing en het detailniveau. Processen waarin ruime grenzen in ruimte en tijd worden gecombineerd met een laag aggregatieniveau (veel detail) vragen normaliter veel tijd en budget.
Volgens de ontwerprationaliteit moeten verschillende beslissingen met betrekking tot schaal worden gemaakt in een beleidsanalyse proces.
In de *ontwerprationaliteit* kunnen drie dimensies van schaalkeuze worden onderscheiden: de observatieschaal, de analyseschaal en de presentatieschaal. Deze kezues zijn sterk aan elkaar gerelateerd en kunnen daarom niet los van elkaar gemaakt worden. Deze dimensies van schaalkeuzes spelen een rol in zowel de keuze voor de ruimtelijke schaal, de keuze voor de tijdsschaal als de keuze voor het aggregatieniveau.

Bij het maken van en het omgaan met schaalkeuzes kunnen vier schaalgerelateerde uitdagingen herkend worden die zijn gerelateerd aan de vier rationaliteiten:

1. Omgaan met zienswijzen vanuit verschillende disciplines op schaal: Hoe om te gaan met verschillende disciplinaire zienswijzen en hoe data en modellen van verschillende disciplines met elkaar te verbinden? Deze uitdaging is gerelateerd aan de wetenschappelijke rationaliteit.
2. Omgaan met verschillende belangen van actoren gerelateerd aan schaal: Hoe om te gaan met de verschillende belangen op een manier die recht doet aan al deze belangen? Deze uitdaging is gerelateerd aan de politieke rationaliteit
3. Schaalkeuzes op een zodanig manier maken dat ze bijdragen aan het bereiken van de doelstellingen op een efficiente manier en rekening houden met de randvoorwaarden. Deze uitdaging is gerelateerd aan de management rationaliteit.
4. Omgaan met schaalverschillen tussen modellen en beleidsvragen. Vaak bestaan er grote verschillen tussen de schaal waarop de data en de modellen beschikbaar zijn en de schaal waarop de resultaten gepresenteerd moeten worden. In deze situaties moet er opgeschaald of neergeschaald worden om informatie te vertalen een analyseschaal naar een presentatieschaal.

Tabel 1 geeft een overzicht van de karakteristieken van de verschillende rationaliteiten, hun zienswijze op beleidsanalyse en de schaalgerelateerde uitdagingen.

De ontwerprationaliteit domineert bij beleidsanalysten, maar ze herbergen ook vaak een combinatie van de andere rationaliteiten. Ze leggen de verbinding tussen de verschillende rationaliteiten door zelf te wisselen van rationaliteit. Om dat te doen pakken ze vaak de rol van een andere rationaliteit op dan op dat moment overheerst, dus in het beleidsproces nemen ze vaak de wetenschappelijke rationaliteit aan en in het onderzoeksproces de politieke rationaliteit of de management rationaliteit.

Tabel 1: Verschillende rationaliteiten in beleidsanalyse en schaalkeuze

	Wetenschappelijke rationaliteit	**Politieke rationaliteit**	**Management rationaliteit**	**Ontwerp rationaliteit**
Zienswijze op beleidsanalyse	Beleidsanalyse is onderzoek	Beleidsanalyse is een proces	Beleidsanalyse is een project	Beleidsanalyse is een artefact
Rol van de beleidsanalist	Kennisintegrator	Facilitator	Project manager	Ontwerper
Uitdaging	Het beleidsproces voorzien van wetenschappelijke valide kennis	Omgaan met verschillende belangen van actoren	Pragmatisme in het omgaan met doelstellingen en randvoowaarden	Creëren van functionaliteit: een ontwerp dat waardevolle uitkomsten oplevert in een specifieke context
Doel	Creatie van kennis en waarheid	Bescherming van belangen	Efficiënte doelbereiking	Beleidsrelevantie
Zienswijze op Schaalkeuzes	Schaal als een systeemgerelateerde karakteristiek	Schaal als een sociaal construct; een instrument om te krijgen wat je wilt	Schaal als een begrenzings-instrument gelimiteerd door randvoorwaarden	Schaal als ontwerpbeslissingen
Schaal-gerelateerde uitdaging	Omgaan met verschillende disciplinaire zienswijzen op schaal	Omgaan met verschillende actorbelangen gerelateerd aan schaal	Schaalkeuzes dusdaning maken dat ze bijdragen aan het efficiënt halen van de doelstellingen	Omgaan met schaalverschillen tussen modellen en beleidsvragen

3. Casussen

Twee beleidsanalytische processen zijn onderzocht om het maken van en het omgaan met schaalkeuzes in de praktijk te bestuderen: de Lange Termijn Visie Study van het Schelde Estuarium (LTV) en de Droogtestudie Nederland (DSN). In beide processen spelen verschillende doelstellingen een rol en zijn vele actoren betrokken die op verschillende schaalniveau´s actief zijn. Voor de analyse van de cases zijn betrokken actoren geïnterviewd en zijn projectdocumenten en aanvullende literatuur bestudeerd. Vier archetypische brillen zijn gebruikt in de cases: de politieke actor, de opdrachtgever, de beleidsanalist en de onderzoeker. De rationaliteiten zijn bruikbaar als onderliggend concept, maar niet als hulpmiddel voor categorisering in de praktijk omdat actoren vaak een combinatie van verschillende rationaliteiten in zich verenigen. De archetypische brillen worden gekenmerkt door een vergelijkbare rationaliteit (en soms combinatie van rationaliteiten) en percepties op beleidsanalyse. De indeling in actorarchetypes geeft een classificatiestructuur die inzicht geeft in de verschillende percepties van actoren op schaalkeuzes. Ook helpt het om inzicht te geven in de manieren van denken van de verschillende betrokken actoren.

Lange Termijn Visie studie van het Scheldt Estuarium

In de LTV was de verdieping van de Schelde een zeer controversiëel issue waarin veel actoren met conflicterende belangen waren betrokken. Hierin wordt de vraag geadresseerd hoe de ruimtelijke afbakening bijdroeg aan het op de agenda plaatsen van de verdiepingskwestie. De keuze voor de tijdschaal bleek ook een controversiële kwestie te zijn omdat de Vlamingen een urgent probleem hadden dat ze snel opgelost wilden zien terwijl de Nederlanders juist veel waarde hechten aan het ecologische systeem van de Schelde en daarom ook effecten op de lange termijn in oogschouw wilden nemen. De interessante vraag die hiermee gemoeid is hoe je een lange termijn visie ontwikkelt als er een urgent probleem op het spel staat. Het ruimtelijke aggregatieniveau was aanvankelijk vrij hoog gekozen om in staat te zijn een lange termijn visie te ontwikkelen, maar tijdens het proces bleek daarin een grote mate van variatie te ontstaan. In de LTV studie vielen de regionale actoren buiten de scope door het hoge aggregatieniveau. Aan het einde van het proces waren de regionale actoren dan ook niet blij met het resultaat. Interessant hierbij was om te beschouwen wat de motieven waren om in meer detail aan de slag te gaan.

In de LTV speelden schaalgerelateerde uitdagingen een belangrijke rol. Het omgaan met verschillende zienswijzen van actoren was lastig vanwege de conflicterende belangen. Schaal wordt een politieke kwestie omdat de focus van het probleem cruciaal werd gevonden. Een bredere schaalkeuze in ruimte en tijd zou leiden tot het betrekken van andere problemen dan de verdieping wat ongewenst was vanuit het oogpunt van een aantal actoren. De onderzoekers werkten in het begin allemaal op hun eigen geprefereerde schaal waardoor het omgaan met verschillende disciplinaire zienswijzen aanvankelijk geen grote rol speelden. Aan het einde echter moesten de beleidsanalisten alle informatie integreren tot één visie en moesten zij omgaan met schaaldiscrepanties tussen modellen/ antwoorden en beleidsvragen. De randvoorwaarden, met name de beschikbare tijd, speelden een belangrijke rol waardoor schaalkeuzes gemaakt werden die bijdroegen aan de efficiency.

Droogtestudie Nederland
In de DSN werd het probleem van de droogte geanalyseerd en werden opties bestudeerd om watertekortsituatie te voorkomen en er beter mee om te gaan. De selectie van de ruimtelijke en temporale afbakening werd gemaakt door de Staatssecretaris van het Ministerie van Verkeer en Waterstaat. De ruimtelijke afbakening bleek vrij gevoelig te liggen en werd herhaaldelijk bediscussieerd tijdens het proces omdat de problemen met droogte zich met name op de regionale schaal manifesteerden. Ook speelden de interacties tussen de regionale en nationale schaal en de stroomgebiedsschaal een belangrijke rol. Een andere moeilijkheid was dat op het moment dat het proces startte droogte niet zozeer gezien werd als een urgent probleem. Overstromingen kregen veel meer aandacht, omdat dat probleem als veel urgenter gezien werd. Droogte werd met name gezien als een probleem op de lange termijn dat groter zou kunnen worden onder invloed van klimaatverandering. De interessante vraag in dit kader is dus hoe je een lange termijn probleem op de korte termijn agenda kunt plaatsen. Eigenlijk dus het omgekeerde probleem van de Lange Termijn Visie in het Schelde Estuarium. Een ander schaalgerelateerd issue was dat in de DSN het aggregatieniveau van de presentatieschaal drie keer hoger lag dan dat van de observatieschaal. Bestudeerd werd hoe dit verschil ontstond en hoe hiermee is omgegaan.

Ondanks het feit dat de ruimtelijke afbakening in de DSN een delicate kwestie was, speelden de schaalgerelateerde uitdagingen hier een minder grote rol omdat het probleem minder urgent was en er geen grote conflicterende belangen op het spel stonden. De consequenties werden niet als erg belangrijk gezien waardoor veel actoren wat onverschillig tegenover de schaalkeuzes stonden. Bovendien hielp de ruimtelijke afbakening niet om regionale actoren te betrekken omdat zij het wat te ver van hun bed vonden. Het lage aggregatieniveau van de modelstudies compenseerde dit: de constructie van de gedetailleerde modellen die de regionale actoren niet zelf konden maken maar wel heel bruikbaar waren voor hen een reden om betrokken te raken bij het proces. De randvoorwaarden van tijd en budget speelden geen belangrijke rol. Mede dankzij de uitgebreide modelstudies op een laag aggregatieniveau werd het project verschillende malen vertraagd en wordt het budget verruimd.

4. Bevindingen

De eerste conclusie van dit onderzoek is dat schaalkeuzes grote gevolgen hebben: zowel voor de inhoud, als het proces als de uitkomst van de beleidsanalyse. Effecten traden op gerelateerd aan alle rationaliteiten, wat bevestigt dat deze rationaliteiten een belangrijke rol spelen in het maken van schaalkeuzes. De bevindingen laten zien dat schaalkeuzes een belangrijk framing instrument zijn dat gebruikt kan worden door de beleidsanalysten en de andere betrokken actoren. De ruimtelijke, temporele afbakening en de keuze voor het aggregatieniveau beïnvloeden het aantal en het type problemen dat wordt bestudeerd, het aantal en het het type oplossingen en het aantal en het type effecten dat wordt geëvalueerd. Het aggregatieniveau beïnvloedt ook de diepte waarin problemen, oplossingen en effecten worden bestudeerd.

Ook beïnvloeden schaalkeuzes het proces: bijvoorbeeld het aantal en type actoren dat in het proces een rol spelen, de mogelijkheden voor draagvlakvorming en de politieke gevoeligheid. De actoren die een rol spelen worden beïnvloed door de ruimtelijke afbakening en het aggregatieniveau. Het ruimtelijke schaalniveau heeft vaak ook effect op het gevoel van betrokkenheid van actoren en de mate waarin zij kritisch zijn (nodig zijn) om het proces tot een goed einde te brengen. Ondanks dat het aggregatieniveau vaak flexibel wordt gehanteerd is het startpunt in het aggregatieniveau van belang omdat dat bepaalt of regionale en lokale actoren een rol spelen en bij het proces betrokken worden of niet. In de temporele afbakening was geen effect geobserveerd op de actoren die een rol spelen in het proces, noch op hun gevoel van betrokkenheid noch op hun macht. Wel kan worden vastgesteld dat verschillende mensen van een organisatie betrokken zijn: als een korte termijn wordt geselecteerd zijn vaak meer praktische, uitvoerende mensen betrokken dan wanneer een lange termijn wordt geselecteerd, dan zijn vaak de meer strategische mensen betrokken.

Ondanks dat de ruimtelijke afbakening, de temporele afbakening en de selectie van het aggregatieniveau afzonderlijk zijn bestudeerd, was het waardevol om ze in één studie te analyseren omdat de cases laten zien dat de schaalkeuzes een nauwe relatie met elkaar heben. De negatieve effecten van de ene schaalkeuze kunnen worden gecompenseerd door de andere schaalkeuze. De separate analyse maakte het mogelijk om het type effecten en de criteria die door actoren genoemd zijn te vergelijken voor deze verschillende schaalkeuzes. De ruimtelijke afbakening, de temporele afbakening en de selectie van het aggregatieniveau hebben een aantal vergelijkbare effecten, zoals effect op de wetenschappelijke validiteit en effect op de mogelijkheden voor draagvlakvorming. Ook lijken de ruimtelijke afbakening, de temporele afbakening en de selectie van het aggregatieniveau een aantal unieke effecten te hebben, wat betekent dat die effecten enkel zijn geobserveerd bij die specifieke schaalkeuze. Unieke effecten van de ruimtelijke afbakening die werden geobserveerd zijn bijvoorbeeld de focus op de agenda en de coherentie van problemen. Unieke effecten van de temporele afbakening die werden geobserveerd zijn zijn de robuustheid van opties, de efficiency van opties en het gevoel van urgentie dat door de actoren wordt gepercipieerd. Unieke effecten van de selectie van het aggregatieniveau die werden geobserveerd zijn zijn de beleidsrelevantie voor lokale problemen en de commitment en het draagvlak bij betrokkenen.

5. Richtlijnen en aanbevelingen

De bevindingen hebben geleid tot richtlijnen en aanbevelingen voor beleidsanalisten in het maken van schaalkeuzes. De richtlijnen die hier ontworpen worden, worden ook wel *framing* richtlijnen genoemd omdat ze tot doel hebben de inhoud en het proces verder in te kaderen. Ook hebben ze een specifieke focus op het beleidsanalyseproces waarin actoren met verschillende belangen en onderzoekers vanuit verschillende disciplines een rol spelen.

Naast deze richtlijnen worden aanbevelingen gegeven die beleidsanalysten ondersteunen bij het ontwerp van schaalkeuzes. Als eerste is het van belang om het maken van schaalkeuzes en de eisen die worden gesteld aan een schaalkeuze te onderzoeken door de doelen van de beleidsanalyse vast te stellen en de randvoorwaarden die daarbij een rol spelen. Hieraan liggen twee redenen ten grondslag: allereerst is het van belang te achterhalen aan welke doelen van beleidsanalyse de schaalkeuzes moeten bijdragen en ten tweede is het van belang welke beperkingen met betrekking tot schaalkeuzes een rol spelen door randvoorwaarden qua tijd en budget. Een controversie scan kan behulpzaam zijn om de potentiële controversie rondom schaalkeuzes bloot te leggen. Een schaalkeuze is mogelijk controversieel als conflicterende belangen een rol spelen en actoren grote waarde hechten aan de consequenties van een schaalkeuze (bijvoorbeeld als deze bedreigend is voor hun positie of belang). Als de potentiële controversie hoog is, is het van belang om de volgende stappen grondig te doorlopen.

Om te voorkomen dat oplossingen te snel uitgesloten worden, is het van belang om een breed scala aan opties voor schaalkeuzes mee te nemen. Om de reikwijdte aan opties te vergroten is het van belang om ook betrokken actoren te raadplegen in het ontwerp van de opties.

In de evaluatie van opties voor schaalkeuzes moet grote zorgvuldigheid worden nagestreefd. Om een uitgebalanceerde beslissing te kunnen maken, moeten de verwachte effecten van opties voor schaalkeuzes vanuit meerdere actor perspectieven beschouwd worden en moeten de meest relevante dilemma’s worden geïdentificeerd. De opties voor schaalkeuzes, de bijbehorende effecten en dilemma’s moeten vervolgens transparant worden gemaakt en bediscussieerd met de bij de beleidsanalyse betrokken actoren. Ook is het van belang alert te zijn op strategisch omgaan met schaalkeuzes door verschillende actoren.

Bij het daadwerkelijk maken van de schaalkeuze, is het van belang dat de keuze matcht met de doelstellingen van het proces. Ook is het van belang dat bij de start van de studie een quick scan op meerdere schaalniveau’s wordt uitgevoerd om gevoel te krijgen voor de interacties tussen de verschillende schalen en dat waar nodig meerdere schaalniveau’s tegelijk tijdens de studie worden gebruikt. Omdat de ruimtelijke afbakening, temporele afbakening en de keuze voor het aggregatieniveau nauw met elkaar samenhangen, is het van belang deze keuzes in afstemming met elkaar te maken. De negatieve effecten van één schaalkeuze kunnen worden gecompenseerd door een andere schaalkeuze.

Als laatste is het van belang dat nadat de schaalkeuzes gemaakt zijn deze ook expliciet tijdens het proces en de documenten benoemd worden om een Babylonische spraakverwarring te voorkomen die kan ontstaan doordat iedereen op verschillende schaalniveau’s een het argumenteren is. Het is daarbij ook van belang deze schaalkeuzes te verantwoorden.

6. Bijdrage van dit onderzoek

Deze studie levert een aantal bijdragen aan het vakgebied van de beleidsanalyse.
Ten eerste laat dit proefschrift het belang van schaalkeuzes zien voor beleidsanalyse. Het maken van en het omgaan met schaalkeuzes brengt een aantal dilemma's met zich mee en als daar niet zorgvuldig mee wordt omgegaan, spelen er ook een aantal valkuilen een rol.

Als tweede laat dit proefschrift zien wat voor specifieke effecten schaalkeuzes hebben op de inhoud door systeemdiagrammen te maken die inzicht geven in welke systeemvariabelen, omgevingsfactoren en opties meegenomen worden op welk schaalniveau. Ook wordt duidelijk hoe schaalkeuzes effect hebben op het proces van een beleidsanalyse door actoranalysediagrammen te construeren die laten zien welke actoren betrokken zijn, en of ze zich betrokken voelen bij het probleem en of ze kritisch zijn (nodig zijn) voor het slagen van het proces). Deze specifieke effecten zijn waar mogelijk vertaald naar framing richtlijnen die bruikbaar zijn in het ontwerpproces van een beleidsanalyse.

Ten derde kan de tool die in deze studie gepresenteerd wordt om schaalkeuzes te bediscussiëren ook behulpzaam zijn om andere fundamentele kwesties zoals verschillen in macht, belangen en verborgen agenda's ter sprake te brengen. Door een schijnbaar onschuldig en inhoudelijk onderwerp als schaalkeuzes te bediscussiëren, kunnen actoren verleid worden om iets meer te laten zien van hun manier van denken en hun strategie.

Tenslotte laat deze studie zien dat door een beleidsanalyse aanpak te gebruiken voor het ontwerp van beleidsanalytische processen, met andere woorden een mini beleidsanalyse uitvoeren bij de start van een proces erg behulpzaam is. Het is eigenlijk ook niet meer dan logisch om, als er veel op het spel staat, een effectanalyse van het ontwerp te doen in een vroeg stadium van het beleidsanalytische proces. Dit onderzoek draagt ook bij aan de kwaliteit van het ontwerp van de beleidsanalyse.

Sonja Karstens, juli 2009.

Curriculum Vitae

Sonja Karstens (4 januari, 1974, Oss) attended the gymnasium in Oss, after which she went to the Delft University of Technology to study Applied Earth Sciences with a specialisation in Engineering Geology in 1992. She also took up a Masters study in Environmental Sciences at the University of Utrecht in 1995. She graduated from both in 1998. In the same year, she became a project leader at GeoDelft, a research institute in Geo-engineering and team leader of the Soil group at the Faculty of Applied Earth Sciences of the Delft University of Technology. In those positions, she was confronted regularly with the tension field between technical research and policy making. Intrigued by that tension field, in 2001, she started as a part-time PhD researcher at the Delft University of Technology at the Faculty of Technology, Policy and Management while continuing her work at GeoDelft.

Currently, Sonja is working as an advisor at the Strategic Exploration and Policy Analysis section and the Geo-Engineering section of Deltares, a Dutch independent research institute for water, soil and subsurface issues. Deltares was formed in 2008 from a merger of Delft Hydraulics, GeoDelft, the Subsurface and Groundwater unit of TNO and parts of Rijkswaterstaat. Her work focuses on strategic explorations, innovation management, and innovation support in networks of public, private and knowledge actors.