MAPPING POWER

Geographical Information Systems, Agenda-Setting and Policy Design

Rebecca Moody

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Chapter 1

Introduction

1.1 WHAT WOULD IT BE LIKE?

When we look at the world around us, we see the physical world and we interpret this physical world. We can view the features of this physical world in several ways. What we can also do, which among other things, distinguishes us from animals, is pretend. Pretend this world is different from what we see; pretend that we are different from what we are. Let's do so and play some 'make believe'.

What would it be like if our cities, the places where we live would be different? Imagine a world in which all the new sites that are to be built where done already, how would they look? Pretend that it would be possible to know how the new building across from your house would look after the construction was done. Pretend that it would be possible to know how the new square where the market is held on Wednesday would look after it was reconstructed. Not the traditional way, by seeing a sketch, but really to know how it would look, experience the new building or the new square, walk around it and look at it from your point of view. Would you like it? Or would you be very disappointed and tell your local government you do not appreciate the new square at all and ask to alter it?

What would it be like if we could predict danger? Imagine that it was possible to predict which sort of natural disaster, for example flooding, would occur, when it would occur and how severe it would be. Pretend that it was possible to tell you, in this event of flooding, how quick the water would rise, and what your chances for survival were and what the condition of your house would be like after the flood. What would you do? Would you move to another country, further from the sea or to some place less prone to flooding? Or would you press your government to take measures to reduce this risk of flooding?

What would it be like if we could prevent sickness? Imagine that we could prevent epidemics from spreading and that we could take measures to make sure illnesses occur at a much smaller scale than they do now? Pretend that we could predict exactly how an epidemic spreads and we knew exactly what to do to prevent this spreading. Would you feel safe? Would you try to make sure you knew what to do yourself and make sure others did so as well? Would you press authorities to make sure they do their part of the deal and take the measures they need to take?

Are we really pretending that this is possible? No, on the contrary, we are not, this game of 'make believe' is currently happening. Are we living in a perfect world, in which all plans are clear, danger can be averted and sickness will be nonexistent? What we see in the game of 'make believe' just described, is that we do now have the technology and the knowledge to do these things, to make this happen. But this technology and this knowledge accounts for the arising of new problems. The question here is, what does this technology, this knowledge and these possibilities really mean, what is the responsibility of citizens, governments and other organizations when possessing this knowledge? How are we supposed to deal with not only the new knowledge but also the new technology making this knowledge possible? Should we share this with everybody or should we keep it to ourselves? Will new problems arise; will this new knowledge and new technology lead us to discover new problems and dangers? How do we deal with those then? Should we make new policy, new legislation to not only making sure the new knowledge is accounted for but also the new issues arising from this knowledge?

There are several theories already dealing with these instances. Theories of agenda-setting account for the way problems, that are not on the political agenda, can be placed on the agenda and how this process of obtaining agenda status for these issues proceeds (Kingdon, 1995; Rogers et. al., 1993). For the making of new policy the same goes, a number of scholars have developed theories on how a policy is designed, how the content of this policy is established (Howlett & Ramesh, 1995). What is less common among scholars is how these processes of agenda-setting and policy design proceed and are conducted when dealing with technology. Do the processes of agenda-setting and policy design proceed differently when they have to deal with new technologies? Do these new technologies account for specific ways the course of these processes proceed, for different ways the content of the processes are filled in and does this account for different outcomes?

Even though some research has been done on the way technology could alter and influence processes of agenda-setting and policy design this does not mean all technology is the same (see: Winner, 1980; Snellen, 2000; Meijer, 2002). In this research the focus will not be on technology in general, this research focuses on a specific technology with specific features. The specific technology that will be emphasized is called Geographical Information Systems (GIS) and it can be classified as a form of Information and Communication Technology (ICT).

GIS are by no means new, they are a form of ICT which mostly can account for the same functions as other forms of ICT's, but they are specific in their being because they deal with a geographical component. Locality is the core of the GIS. Very little research is done on what the influence of the use of GIS is on the processes of agenda-setting and policy design. Since GIS are used more and more in public policy and since they are used in more fields then just earth sciences (see: Meijer, 2002; Snellen, 2000; Moukomia, 2004; Greene, 2000; Weiner et al., 2001; Lips et al., 2000). This research aims to contribute to a body of knowledge on what the influence of these GIS are on public policy.

1.2 GIS, AGENDA-SETTING AND POLICY DESIGN

There are a number of issues relating to public policy that concern us everyday, some are minor and some are larger. Not all of these issues are actually discussed within politics or public administration. There are several issues that will not be addressed at all, not the problem itself, nor the way others perceive this problem, no solutions are addressed and no alternatives listed. The issue itself does simply not reach the political agenda (Kingdon, 1995; Rogers et. al., 1993). The question here is then, why do some issues reach the agenda, and why do other issues fail to do so? What determines whether an issue reaches the agenda or fails to reach agenda status?

When an issue actually manages to obtain agenda status this does not mean new policy will be made on this issue. First this policy needs to be designed. What is meant by policy design is the process before the actual decision-making or implementation stage. Policy design is therefore seen as the process in of defining, considering and accepting or rejecting options for political decision (Howlett & Ramesh, 1995). The question to consider is how an alternative becomes ready for political decision, how do we come up with the problem definition and the solution for this? Why have we chosen this solution instead of any other solution and how has this process advanced?

Technology is used more and more to enhance these processes of agenda-setting and policy design. Different forms of ICT are used to expand issues to a greater audience, for example through the Internet, but also to make sure governments are aware of the issue at stake. Furthermore, forms of ICT are used in policy design, for example, they can help to calculate the costs and benefits of alternative solutions. Also they can make sure that those who own the ICT application hold an information monopoly, which accounts for their preferred solution to be more likely to be chosen. It is therefore to be expected that ICT applications could have a large effect on processes of agenda-setting and policy design. Several authors have recognized this effect and have made sure to document the influence (see: Bekkers et al., 2005; Bijker, 1995; Hoff, 2000; Orlikowski, 2000).

However, while the effect of the use of ICT on processes of agenda-setting and policy design has been researched to a certain degree, the influence of specifically GIS has received little attention. At the beginning of the ICT hype in the early 1990s governments were unaware of how much of their information was spatially based. They were stunned to see that GIS could be used in more fields than just the traditional geo-sciences. Possibilities for public participation through GIS have arisen; the use of GIS in non-traditional sectors, like crime or public health has emerged (see: Greene, 2000, Weiner et al., 2001; Pollard, 1998, Carver et al., 2000). Now, even though the use of GIS in the public sector has become common practice in a number of different fields, the effects of the use of this technology in terms of agenda-setting and policy design are still very poorly researched.

Questions on how the use of GIS could influence the way these processes develop are not addressed, as well as the question of how the use of GIS could influence the content or the outcome of these processes.

1.3 RESEARCH QUESTIONS AND SCOPE

The goal of this research is twofold. A first goal is to establish how the perception and use of GIS influence processes of agenda-setting, in terms of the course of the process, the content and the outcome. A second goal is to establish this in terms of policy design. The main research question therefore is as follows:

> *How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?*

In order to come to an answer to the main question several sub-questions are formulated. Several steps must be taken in order to come towards this answer. It is to be seen that GIS are used increasingly in different fields of interest. Where GIS before was a technology used only in earth sciences, now GIS is used in other fields of study and policy with a more socially based perspective (Greene, 2000; Pollard, 1998; Lips et al., 2000, Carver et al., 2000). It is also important to research what GIS actually is. What does the underlying technology entail and what are the possibilities of this technology? Also the possible qualities are that are attributed to this technology by several actors in the field as well as different scholars will be looked at (see: Bekkers et al. 2005; Lips et al. 2000; Meijer, 2002; Carver et al., 2000; De V. Borges, 2000; Moukomia, 2004; Overchuk et al., 2004; Turner & Higgs, 2003). This leads to the first sub-question namely:

> *What are Geographical Information Systems, which qualities are attributed to them, and how and in which fields are they used?*

When elaborating on what GIS are and what the qualities attributed to them are, it should be considered that these might not be fixed. The idea that technology should be looked at from a deterministic, positivistic point of view is often criticized (see: Williams & Edge, 1996; Winner, 1980; 1997; Orlikowski, 1992; 2000; Orlikowski & Gash, 1994; Pinch & Bijker, 1984; Bijker, 1995). There are different ways to look at the world and therefore also to look at technology. This is found back in the technology debate, a debate in which several standpoints in epistemological positions come forward. In this research a more social constructivist approach would fit better when looking at perceptions of actors when using GIS. The second sub-question therefore sounds:

What is the epistemological position that fits the analysis of Geographical Information Systems and their influence on agenda-setting and policy design best, and what does this position mean for the research?

After the epistemological position of the research has been dealt with the theoretical part must be addressed. The core theoretical emphasis of this research deals with agenda-setting and policy design. Namely what are these processes and what do they entail? There exist several theories on both processes which all place different emphasis on different variables (Bachrach & Baratz, 1970; Cobb & Elder,; 1972; Kingdon, 1995; Sabatier, 1993; Dror, 1968; Etzioni, 1967; Lindblom, 1959; March, 1994; Ostrom et al., 1994; Simon, 1976). These existing theories on agenda-setting and policy design can help to explain what the influence is of the perception and use of GIS in these processes. Therefore these theories need to be elaborated on in terms of what they entail and how they could help in researching this influence relating to GIS. This leads to the third sub-question:

What is agenda-setting and policy design, what do existing theories on both processes entail and how can these existing theories help to research the influence of the perception and use of Geographical Information Systems on these processes?

In the conceptual framework that will be developed in this research the processes of agenda-setting and policy design when dealing with GIS will be outlined. The conceptual framework will account for how to assume and expect the course of the separate processes of agenda-setting and policy design to proceed. The sub-question that follows from this can be framed as:

In which way is it to be expected that processes of agenda-setting and policy design proceed when dealing with Geographical Information Systems?

The conceptual model will then be tested against empirical findings derived from the usage of GIS. Six empirical case studies have been conducted to not only test the model but also to research the influence of the perception and use of GIS on processes of agenda-setting and policy design. In order to attribute to the internal validity of the research the case studies are all conducted in different fields of policy. Based on these empirical findings it will be established to which degree the relations stated in the conceptual framework need to be fine-tuned. Therefore the fifth sub-question sounds:

What is the actual influence of the perception and use of Geographical Information Systems on processes of agenda-setting and policy design in terms of course, content and outcome of these processes?

After dealing with the empirical findings and the relation between these findings and the conceptual framework all the sub-questions will come together in order to answer the main question.

1.4 RELEVANCE

In terms of scientific and societal relevance this research can be seen as contributing in several ways. In terms of scientific relevance this research aims to contribute to three topics.

Firstly this research aims to focus attention to GIS itself. A lot has been written on ICT in the public sector but research on GIS as application is not to be found very frequently. Even though some research is done this is very limited (see: Lips et al., 2000; Turner & Higgs, 2003; Meijer, 2002).

Secondly this research aims to gather some insights in how technology, and specifically GIS, can influence and alter processes of agenda-setting. While there is a large body of knowledge on agenda-setting processes, the impact of technology on this process is not researched very extensively. This research aims to contribute to this and will try to establish some relations between GIS and the course, the outcome and the content of processes of agenda-setting.

Thirdly the same will be done for policy design. As for agenda-setting there exists a lot of literature on policy design but the influence of GIS on this process is not researched very extensively. GIS and its influence on public policy are researched in terms of decision-making and implementation and evaluation but not in the field of policy design (Moukomia, 2000; De V. Borges & Sahay, 2003; Green 2000). This research therefore aims to contribute to a body of knowledge on how GIS can influence or alter processes of policy design, their course, content and outcome.

In terms of societal relevance this research aims to contribute to the practice of agenda-setting and policy design in the public domain. GIS are used more frequently and they are unique in the way they treat location. They are able to link data to a specific location and link this data to other data with a locational component. This is not necessarily just done in earth sciences but can also be done with other societal problems like traffic, crime or public health.

This could help governments and public administrators to change the way in which they design policy. Firstly a more advanced discussion on this policy can be held. With the new information GIS can generate, the political discussion on a certain topic can be based on evidence and can be taken to a higher level, which could result in more effective policy.

Secondly GIS holds the quality of making very complex data visible in a way a lot of people can understand this data. Before using GIS only those experts in the field could interpret the tables and graphs with data. Now effects, consequences and potential dangers of certain policy alternatives can be made visible in a map or movie, which is sometimes interactive. In this way public administrators are able to interpret the data on their own and communicate the data to citizens in a comprehensive manner. This could also enhance the quality of public policy-making as well as communication towards citizens. Politicians can be more aware of consequences and effects of certain policy choices and might therefore be able to design more effective policies.

1.5 STRUCTURE

This thesis will be built up by several chapters making sure the main question will be answered in the end. The structure of this thesis will be as follows:

In chapter 2 it will be elaborated on what GIS entails. It will be explained what makes GIS part of ICT's but also what makes GIS different from other forms of ICT's. Furthermore it will be demonstrated that GIS are used increasingly, not only in terms of number of applications but also in terms of different fields of policy. On the basis of existing literature on GIS the different qualities scholars claim GIS to have will be explained. (*Sub-question 1*)

Chapter 3 will deal with the epistemological position of this thesis. The technology debate will be dealt with and the different positions within the technology debate will be explained on the basis of literature. A justification for the choice of a social constructivist viewpoint on technology will be accounted for. (*Sub-question 2*)

In the fourth chapter the theoretical notions of agenda-setting will be explored. It will be explained what agenda-setting entails. It will be argued that there exist several theories on agenda-setting that can be useful in explaining the influence of the perception and use of GIS on agenda-setting. These theories will be explained in detail. (*Sub-question 3*)

In chapter 5 the same will be done for policy design as for agenda-setting in chapter 4. It will be explained what policy design is and again several theories, that can be useful in explaining the influence of the perception and use of GIS on policy design, will be elaborated on. (*Sub-question 3*)

Chapter 6 will deal with three matters. First the research design will be outlined. Here the concepts and variables of the theories of agenda-setting and policy design will be operationalized into researchable concepts. Secondly the conceptual frameworks of agenda-setting and policy design will be constructed. This will be done on the basis of the concepts of agenda-setting and policy design but also within the boundaries of social constructivism. The conceptual frameworks will account for some expectations regarding the relations of variables in agenda-setting and policy design. Finally the choice for multiple case study research but also for the particular case studies themselves will be justified. (*Sub-question 4*)

Chapter 7 to 9 will deal with the case studies on agenda-setting; one chapter will be dedicated to each case. For each case first the background of the case will be dealt with, next the GIS application, finally the conceptual framework of agenda-setting will be applied to the case study. The cases discussed here are HIS and FLIWAS, which deal with water management and prevention of flooding, The Riskmap, which deals with internal risk communication from governments to citizens and contagious live stock diseases which deal with prevention and containment of contagious live stock diseases. (*Sub-question 5*)

Chapter 10 to 12 will deal with the case studies on policy design; again one chapter will be dedicated to each case. The background of the case and the GIS application will be dealt with and the conceptual framework of policy design will be applied. The cases discussed here are Virtuocity, in which the renewal of two urban centers is communicated to citizens in a three-dimensional, real time manner, particulate matter, in which GIS is used to assess and predict concentrations of particulate matter and Congestion Charging, in which GIS is used to deal with traffic congestion problems. (*Sub-question 5*)

In chapter 13 a comparison of the case studies will be made. Here the agenda-setting cases will be compared with one another as well as the policy design cases. Also all six cases will be compared in order to obtain insight in the influence of the perception and use of GIS in processes of agenda-setting as well as policy design.

In chapter 14 conclusions will be drawn and an answer to the main question of this research will be given.

Chapter 2

Geographical Information Systems in the Picture

2.1 INTRODUCTION

Geographical Information Systems (GIS) are used frequently in different fields of public policy; the time when GIS was only used in fields of policy dealing with earth sciences is now in the past. Now is the time to explain what GIS are and to put them in the picture. The aim of this chapter is to explain what GIS actually are, how they are used in practice and how they are perceived. This is important in answering the main question. It is relevant to understand what GIS actually are and in which ways they can be used to understand the relevance of GIS for public policy. In this chapter the focus will be on the first sub-question: What are Geographical Information Systems, which qualities are attributed to them, and how and in which fields are they used?

In order to answer this question firstly it will be explained what GIS are, how they function and what the thought behind a GIS application is. After this the history of GIS applications will be discussed. It will be demonstrated that even though GIS has been around for a few decades the ICT hype made sure that GIS has been used more frequently and in more sectors of public policy-making. Here also the expectations on the potential of GIS made during the hype will be elaborated on. In paragraph 2.4 some case studies, done by several authors, will be described for the purpose of guaranteeing a proper understanding of GIS. Secondly this will demonstrate possible use of GIS. And thirdly it will show that a lot of research on GIS in the public sector, however not in the field of agenda-setting and policy design, has already been conducted. On the basis of the findings of a number of authors and on the basis of the expectations made during the ICT hype, it can be demonstrated that GIS has a number of qualities and functions that are said to enhance public policy-making. This could potentially be the case for agenda-setting and policy design. These functions and qualities will be elaborated on in paragraph 2.5.1. Furthermore it must be noted that not all the expectations made during the hype together with the qualities and functions, in practice are actually fulfilled. The factors limiting this, as described by authors, will be listed as well. Finally in the end of this chapter a summary will be given and some conclusions will be drawn.

2.2 GEOGRAPHICAL INFORMATION SYSTEMS, WHAT ARE THEY?

In order to grasp the main question it is first important to understand what GIS are. GIS are a form of ICT that hold the features of ICTs but can do more and are more specific in nature. They can be used, like most forms of ICT as computerized systems that can order, manage and integrate large quantities of data. For GIS this data is always spatially oriented, this data is called geo-data (Meijer, 2002; Snellen, 2000; Haque, 2001). This data can be analyzed by using GIS and can be presented; this will be done mostly in the form of a map. (Meijer, 2002; Snellen, 2000) In practice this means that GIS makes it possible to visualize spatial distributions of social entities and phenomena and their characteristics. These can than be combined with the geographical spread of other social entities and their characteristics. The dynamics between these entities can be registered, analyzed and visualized (Snellen, 2000). The core of what makes GIS different from other forms of ICT is the link to location, GIS always works with physical coordinates and always links data to a geographical location. This geo-information can be linked to other geo-information, establishing a correlation between the two or more types of data. This can occur in typical earth sciences like water management or land-use but this can also be done for social issues as for example public health or crime mapping. The specific possibility of GIS to visualize data in the form of a map or an interactive movie makes it different from most other forms of ICT which concern large amounts of data. Mostly this data are cannot be visualized in a simple way a lot of people understand.

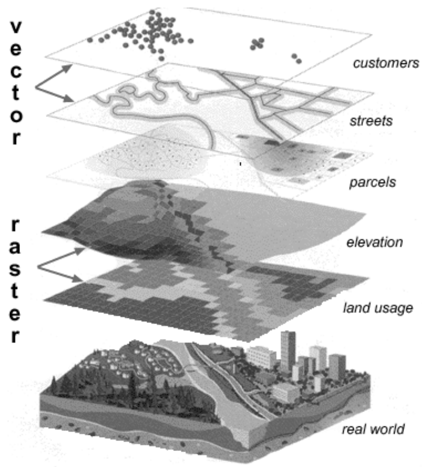

Figure 2.1: Layers on Top of each other in a GIS (NOAA, 2009)

The way a GIS application mostly operates is through layers. What this means is that one layer of data will be placed on a map, linking this data to the geographical data on the map. Another layer of data can be placed over this, not only will this data be linked to the data in the first layer but also to geographical location. An endless amount of layers can be placed on top op each other and the results of the linking of these layers can be analyzed, visualized and interpreted. These layers can be divided into raster layers and vector layers. In raster layers the data is set out on a grid, comparable with how pixels in a digital photograph are made. In vector layers, lines and points are set out.

Where GIS applications can be very complex applications that require education to be able to work with, there are also GIS applications that are commonly used. For example there is Google Earth which displays the earth in different layers, like roads, water, historical buildings and so further. The capacities added later, like street view and the possibilities to add data and pictures are also part of the GIS. (earth.google.com)

Even though GIS have been used since the late sixties the potential of GIS was not realized by non-traditional earth scientist until later and governments only became aware of this potential even later as the next paragraph will show.

2.3 THE HISTORY OF THE USE OF GEOGRAPHICAL INFORMATION SYSTEMS

GIS has been used since the late sixties but the real potential of GIS was not realized by a lot of actors until the 1990s. At the beginning of the ICT hype around 1990, expectations on the impact of GIS on policy-making were high. In 1990 it was expected that the United States would spend 12 billion dollar on GIS software and hardware and another 15 billion dollar on data conversion (Lang, 1990). Articles convincing governments to use GIS in their decision-making procedures arose out of every corner. These articles promised a faster, more reliable way of decision-making, more use of existing spatial data and a better oversight of all existing alternatives, possibilities and consequences. These articles argued that governments did not realize themselves how large the amount of data was that was spatially based. They also urged governments to share their data so new information could be generated, standardization would be the norm. At the time GIS were referred to as 'smart maps' (Lang, 1990; Felleman, 1990).

In the early 1990s the idea of using GIS in public participation, democratization and interactive policy-making came into play. At first policy-makers and technicians were sceptical about this. Questions came up referring to whether a bottom-up GIS actually could be made, or how to involve the community into a complicated application like GIS. Other questions were aimed at to what extent participation would serve to legitimize top-down decision-making (Carver, 2001). But regardless of these questions, governments as well as technicians were extremely enthusiastic about the idea that there would be an understandable ICT application with which participation and democratization could be facilitated.

These issues were finally resolved and in the mid-1990s. Decision-makers as well as technicians proved to be very enthusiastic about the idea of using GIS for means of public participation and interactive policy design. It was believed that using GIS in interactive policy design would be the future, it would close the gap between citizen and government and that decisions would be perceived as more legitimate. (Weiner et al., 2001)

At the beginning of the ICT hype it was expected that within ten years governments would have standardized all their datasets and would be sharing all their information in order to come to a transparent and reliable policy. Data from different organizations, different departments and different layers of government would be linked to one another and information that was invisible before would be visible now. This would reflect on decision-making and policy design. With all this new information policy would not only become more transparent but also based on rational calculation of cost and benefits and prediction of consequences (Lang, 1990). It was assumed there would be a lot of money available for training so government organizations were able to work with GIS. It was also assumed that citizens would have access to the Internet and therefore could be included in processes of public participation; interactive policy-making through the Internet would become the norm (Weiner et al., 2001).

Information would be more transparent and rationality of decisions would increase. Decision-makers would be limited in their rationality by a lesser degree since GIS would be able to analyze costs and benefits more accurately and consequences of policy alternatives could easily be predicted (Lang, 1990; Felleman, 1990). Transparency would not only be increased in the way citizens could look at policy-making but also in making standards and work procedures more transparent for the government itself. While GIS would be able to link different datasets, generate new information and make existing information clear in a blink of an eye, bounds of rationality, as was expected, would seriously be lifted. Before in policy-design a number of costs and benefits could not be calculated and consequences of a certain policy could not be predicted. Now, the new applications of GIS would certainly make sure that these consequences could be predicted more accurately and based on appropriate cost and benefit analyses.

At the time hopes were up, expectations where high and an enormous potential was seen in the future of GIS. When looking at the use of GIS today it can be seen that GIS is indeed used in very different fields of policy but does not live up to expectations. In the next section some case studies will be presented and later it will be demonstrated why these expectations were not lived up to.

2.4 GEOGRAPHICAL INFORMATION SYSTEMS, HOW ARE THEY USED?

The information that can be generated by using GIS can be used in a number of ways. In the early days of GIS the application was only used for traditional earth sciences, but now GIS are also used in social fields of public policy. Internationally a wide range of examples can be found of what GIS can be used for in public policy. A number of authors have looked at, mostly, single case studies of GIS being used in public policy. Some examples of these cases can be described.

A first example is the example of the use of GIS in Thailand. Thailand has been hit hardest by avian influenza in 2003 and 2004. At the time, the Thai government has used a GIS application to generate information on the spread of the avian influenza, the actual spread as well as the probable spread in the future. This was done for the purpose of helping them decide which measures to take in order to establish prevention measures. The information on the outbreak areas was matched with the information of land-use and transportation. This made sure an analysis could be made on the direction of the disease and measures could be taken to prevent further spreading. All relevant organizations were able to view this data so they were sure to know what they were supposed to do (Moukomia, 2004).

A second example involves the land use in Russia. When in the beginning of the 1990s the system of solely public land-use had disappeared, land ownership had to be restructured. This was not easy since farmland played a major role in social life. These farms provided for, next to farm commodities, social infrastructure, public transport and other utilities. An economic market for agricultural land had to be established and a policy had to be formulated to redistribute the land to private individuals or enterprises. In this policy other interests, like forest, irrigation, road planning and environmental protection, had to be incorporated. GIS was used to document the parcels for farming and to incorporate all legal documents concerning individual parcels. The quality of the land also needed to be taken into consideration. GIS made sure that parcels could be weighed on this quality. These GIS applications together formed the basis of the draft redistribution plan. The result was that the plan was implemented. Due to the use of GIS the plan was performed with fairly low costs and in a rather short time, otherwise, a nationwide plan for reallocation would not have been possible (Overchuk, 2004).

Thirdly in Brazil the public transport system had to be restructured. The transportation system was to be set up in a way that people could travel the most efficient, cheapest and safest route through the city. GIS was used to simulate all alternative plans. A GIS application was made by combining all information, listing every traffic sign, every legal turn, every bus stop, all one-way roads and all existing bus routes. Additionally the routes most frequently used were mapped. In this map simulations were made of possible alternatives for the new public transportation system. Cost-benefits analyses of the alternatives were made and finally an alternative was chosen and implemented. GIS, in this case, made possible that policy-makers could compare the different alternatives in a visible, integrated way. Policy-making became a lot easier (De V. Borges, 2000).

A fourth example can be found in California where GIS is helping to make sure federal funds are fairly distributed among different schools. Under the provisions of the 'Improving America's Schools Act' schools with a large number of children of low-income families receive extra federal funding. This initiative was based on linking children of low-income families to individual schools and to calculate which school should receive extra money and how much. This proved to be a problem; the information on low-income families was listed in one database and the school district information in another. Furthermore the maps of the school attendance zones were aged and not well kept. GIS provided for a solution. First files of school districts were made, schools were placed within it, and attendance zones were added. The files containing all streets and addresses, as a layer, were place on top of the map. Next the files on low-income families with children were incorporated in this map. This provided for a clear view and GIS was able to calculate how many children of low-income families were attending each individual school (Greene, 2000).

GIS is also used in health care policy, as was the case in Yakima County, Washington State. Because of the high infant mortality rate, a program was designed called 'First Steps' to make sure infants of low-income mothers received extra care additional to the care provided by Medicaid, while mothers were also given prenatal care. In 1998 policy-makers discovered that twenty five percent of the woman entitled to the extras provided by 'First Steps' were not making use of it. The question was, who are these woman and why are they not using this? GIS was used to answer this question. First all birth records were linked to addresses and placed on a map. All Medicaid births were identified by census block and made visible on that map. By census block average age and education level of mothers was mapped as well. It then became very easy to identify who was not making use of 'First Steps', by putting the census blocks with Medicaid births together with the woman using 'First Steps'. It became clear that not, as expected originally, the young, low educated, non-American born woman were not making usage of 'First Steps' but the older, slightly better educated, American born woman. GIS made sure in this case, that a policy could be formulated for a campaign directed at the right group of woman (Greene 2000).

2.5 QUALITIES OF THE USE OF GEOGRAPHICAL INFORMATION SYSTEMS

What becomes obvious when looking at the case studies is that not only does GIS make sure the information needed can be provided but in the field of public policy GIS are also said to have some qualities. These qualities can be divided into qualities that enhance the process of public policy but also into factors that limit the process of public policy. There are a number of authors who have listed the potential of GIS to enhance public policy (see: Moukomia, 2004; Overchuk, 2004; Lips, 2000; Pollard, 1998; Carver, 2001; Greene, 2000) but there are a number of cases seen in which these effects are limited by several factors and the expectations made on the potential of GIS are not lived up to (Lips, 2000; Bekkers & Moody, 2006; Pollard, 1998; Kingston et al., 2000). First the enhancing qualities will be discussed and after that the limiting factors.

2.5.1 Enhancing Qualities

GIS are said to have several enhancing qualities for the process of public policy relating to agenda-setting and policy design, as expected during the ICT hype. One of those qualities of GIS is integration. Integration can be divided into integration of datasets and into standardization, the integration of work processes within and between organizations. With regard to the integration of datasets, GIS can link these different sets, by placing them above each other as layers. Now information that was unseen before, can be generated. This can help agenda-setting and policy design to a large degree (Bekkers & Moody, 2006). For standardization, GIS can account for a function of control and discipline. This means that GIS can be used to standardize work procedures so all organizations work with the same application and every organization can see what the other organization has done (Lips et al., 2000, Bekkers et al. 2005; Hout & Bekkers, 1998). In the California case, GIS helped to integrate the information on low-income families, school districts and school attendance zones. The procedure for extra funding was set in this way and transparent for different public administrators (Greene, 2000).

A second quality GIS are said to have is calculation. This means that GIS can calculate different algorithms and make a possible cost-benefit analysis a lot easier. Through GIS it becomes easier to develop a more sophisticated 'if …then' reasoning. Through simulations it becomes possible to try out different scenarios and the best alternative can be chosen. In this way actors are able to evaluate policy alternatives, costs and benefits can be predicted more accurately and predictions can be made. For example, in the case of the avian influenza in Thailand, GIS made it possible to predict how the disease would spread, depending of the mobility of the animals (Moukomia, 2004).

Thirdly GIS are said to hold the quality of visualization. This quality is very important since this is, next to the fact that all data in GIS is spatially oriented, one of the qualities that differentiates GIS from most other ICT systems. At this moment we observe that advanced visualization (three and four-dimensional graphics), multi media and simulation tools are integrated within GIS capabilities. The result is that plans become more visible. GIS are able to visualize very complex data and in this way the data can be made clear to a number of people who would have not understood the data before the use of GIS. In this way people do not have to look at a plan on paper anymore but can actually 'see' the plan. This virtual world may help choosing between alternatives in policy (Bekkers et al., 2005; Hamilton, 1996). For example in the USA GIS has been used to look at the social capacity of a neighborhood. Urban crime rates were used to determine hotspots and by placing all this information into GIS a comprehensive overview could be made (Grubesic & Mack, 2008). Another example is the visualization of noise in Thailand, where GIS was used to visualize the noise motorways account for in a three-dimensional environment. In this way not only the spread of the noise could be viewed on a 'flat map' but also in terms of height (Pamanikabud & Tansatcha, 2009).

Next to qualities GIS are also said to have effects. As a result of the functions mentioned above GIS can account for an increase in communication. This increase in communication is twofold. Firstly communication between organizations of experts must be dealt with. Here it is to be found that because of standardization different experts now have the means to communicate with one another. The GIS application is often available on the server of all the involved experts so these experts know what other experts are doing. Secondly communication from experts to governments and citizens can be enhanced. This can be explained by the visualization function; here we see that experts are more able to explain their findings to governments and citizens since now they have a tool to show them (Haque, 1996).

Finally GIS can hold the effect of increased transparency. GIS is said to increase transparency by structuring work processes. Data can be collected on the course of these processes, the process in itself in this way becomes more transparent and this opens the possibility to adapt these processes. Next GIS can help approach different angles of a policy problem and in this way increase the accessibility and transparency of the problem. Also GIS can make, sometimes on the web, policy proposals visible for people all over the world; this could benefit e-government to a large degree, as several experiences teach us (Carver et al., 2000; Moukomia, 2004; Overchuk, 2004). An increase in transparency can be achieved while GIS can visualize complex data in a very simple way, so one could understand a policy proposal right away (Bekkers et al., 2005).

2.5.2 Limiting Factors

Although the qualities and effects listed above can be found in empirical case studies there are also some factors limiting the enhancing effect of GIS on public policy in the field of agenda-setting and policy design. These factors can be listed as follows (Bekkers & Moody, 2006). A distinction can be made between instrumental factors and institutional factors.

For the instrumental factors, the first factor that needs to be mentioned is linked to integration. The possibility of sharing data between organizations or departments often proves to be difficult. This can be explained first by different organizations having different priorities. One organization might be willing to share information for a specific purpose; if the other organization does not believe this purpose to be a priority it will not be willing to put the manpower, or the costs, into this. This issue becomes even larger when organizations do not only differ in their priority listing of certain interests, but when these interests are conflicting. Sharing becomes extremely undesirable for the organization since it will counter serve their interests (Turner & Higgs, 2003).

Secondly the proper contacts with the organizations one would like to share data with might not be present. Additionally privacy issues and lack of resources might add to this (Turner & Higgs, 2003). Also, the data is often priced and very expensive to obtain, this also accounts for some constraints.

A third limiting factor is the technical knowledge needed to operate a GIS application. Even though GIS has a large potential, a lack of technical knowledge can prove to be a problem. This can occur in two ways. Firstly when GIS is used in matters of public participation, when not everybody has the technical knowledge to deal with the application, participation could be difficult. In this way, public participation through GIS is seriously hindered and will not prove to have the democratization effects originally aimed for, since certain groups are excluded by means of technical knowledge (Carver, 2001; Weiner et al. 2001; Haque, 2001). Secondly, the constraint accounted for by technical knowledge also applies for organizations and departments that are used to traditional systems and are often not able to work with GIS. The result might be that extra money for training should be made available in the best case and in the worst case, misinterpretation of data or the rejection to use GIS as a whole (Pawlowska, 2001).

Another problem seen in literature on GIS is that while mostly data is provided by governments, societal organizations and citizens do not trust the data and refuse to work with the GIS application. The original aim of the application might not be realized because of the rejection of the data by others (Carver et al. 2000).

Fifthly and also linked to integration a major factor that withholds GIS to be optimally used is the incompatibility of datasets. Data can be very difficult to be shared especially when there are no standardized systems for this (Bellamy & Taylor, 1998). Efforts are being made to achieve national standardizations but the results are still limited (Pollard, 1998).

A sixth factor is the data itself. Often data is simply not available so an application cannot incorporate this data. Additionally the price of data proves to be a problem. The pricing of data is often not regulated and the data is far too expensive to buy for local governments (De V. Borges, 2000; Pawlowska, 2001; Pollard, 1998; Kingston, 2000).

For the institutional factors the first factor that needs to be noted is in order to achieve standardization, as stated above, often restructuring of an organization is needed. Not everyone in an organization proves to be ready for, or positive about change. It shows that this is a large obstacle for fully implementing GIS. Autonomy issues prove to be a large problem. Organizations are often not willing to compromise their autonomy and want to work within the structure they decided on and they are often unwilling to lose power to new or other agencies. In the using of GIS for policy, these authorities prove to defend their share of power and thus direct policy and the usage of GIS in another direction. The main fear of authorities is that decisions on their territory are not made by them anymore and that they will be placed for an established fact once the decision is made. Authorities are thus reluctant to cooperate in a GIS application for policy and might be unwilling to share certain information. This is what happened in a project in the Amsterdam region in the Netherlands in which a GIS application fostering an interactive public service counter with fully integrated real estate information was being established. An intermediary organization was set up in order to decide on issues related to the GIS application; the organization had the authority to decide over individual local governments. This met a great deal of resistance by these local governments because they perceived themselves powerless in the decision-making process. As a result the decision-making arrangement had to be altered drastically (Lips et al. 2000).

Secondly the legal framework is important. Privacy regulations, might in some cases, make it impossible to use certain data, or to broadcast this data publicly. This proves to be a large constraint on the diffusion of GIS applications. For example, the GIS application containing the data on Medicaid in the United States are confidential, they could thus not be used in the 'First Steps' program described above. This was the reason analysis was done by census block and not by address. The Medicaid application proved to be useless because of privacy laws and thus could not be used a way that would support public policy best (Greene, 2000). Intellectual property rights make the data more expensive than they originally were and make it hard to publish data publicly. The usage of GIS and the degree to which GIS is used in this matter is thus very much dependent on the legal framework for privacy and intellectual property rights. Legal systems that are very rigid on these matters will see the usage of GIS in a lesser degree than legal systems that are not (Carver et al. 2000; Turner & Higgs, 2003; Schalken et al., 1996).

Another factor is linked to transparency. As mentioned, GIS can provide for more transparency in public policy. Where this at first glance seems to be positive, it also proves to have some downfalls. Organization fear when more transparency is achieved, comparisons can be made between organizations this could lead to more demands of harmonization of policy and thus to take power out of the hands of these organizations (Lips et al. 2000).

Finally it must be mentioned that while these hurdles and constraints to the optimal use of GIS prove to pose problems for basically all countries, the developing countries have an extra hurdle. Namely, mostly GIS programs are financed by international aid programs and planned for two to three years. As soon as the money dries up the GIS application is neglected and not further used. Additionally, mostly the international aid programs send their own experts over to the developing countries, when the program ends they leave; locally there is nobody to operate the GIS application. Another problem is that these experts do not have a lot of local knowledge and try to place western standards in the GIS application; locals then might be very unwilling to cooperate (De V. Borges, 2000).

2.6 CONCLUSION

After looking at all the above it can be summarized that GIS are forms of ICT that hold the same features as other ICTs except that the data used for GIS is spatially based and that GIS has an advanced feature of visualization. Furthermore it is to be seen that GIS can manage, order, analyze and calculate large quantities of data while using different layers placed on top of each other.

Even though GIS has been around since the late sixties of the past century, during the ICT hype a lot of different organizations and parts of government realized GIS could be useful in fields that did not deal with traditional earth sciences. Expectations of the potential and potential use of GIS were very high. It was expected that policy-making would become more rational, that every organization would share their data, that policy and policy-making would become more transparent. The given examples of case studies demonstrate that GIS is indeed used in a lot of different areas of public policy and that some of these expectations have indeed come true. Additionally authors have claimed that the expected qualities and functions of GIS are indeed present for public policy-making. These qualities and functions include increased integration, not only of datasets but also of work processes, making sure organizations work together. Secondly GIS can make enhanced calculations, making it possible to do simulations and calculate effects. A third quality is visualization which makes sure complex data can be viewed in a simple way. Fourthly increased and improved communication is mentioned, because of the visualization and integration functions. Finally increased transparency, in the work process but also in the policy process itself is listed.

However, even though these qualities and functions are present in research by several authors, there are factors limiting this potential. These factors are recognized by several authors. A first factor is that sharing of data does not always move as smoothly as hoped for, because of conflicts of interests. Contacts between organizations are often lacking and privacy and intellectual property rights limit the sharing of data as well. Another factor is that datasets are often incompatible which demands for restructuring and standardization. This often poses a problem since organizations fear losing autonomy. Knowledge on how to operate a GIS is also a limiting factor in fulfilling expectations as well as distrust of data. The data itself is often not available or very expensive.

This demonstrates that even though the potential is there and can be found in empirical cases this potential is also limited. These limiting factors could also be present in the use of GIS in agenda-setting and policy design.

Chapter 3

Technology and Society. What is Real?

3.1 INTRODUCTION

In the previous chapter GIS was the central point of emphasis, GIS has been looked at from a rationalistic approach. Here it was explained for which purpose GIS could be used and for which purpose they actually are used. Also it was explained what GIS applications actually entail. Now it is time to look at GIS on a higher level, this in terms of what GIS means, what their relation towards society is and what this relationship could be. It is necessary to find an epistemological position to look not only at technology but also at society, policy and humans. This has to be done in order to make sure this research can be conducted in a way in which the collection of data and the analysis of this data proceed in a coherent manner. Therefore it is important to establish which epistemological position is advocated and will be used to value reality. This chapter aims to answer the second sub-question: What is the epistemological position that fits the analysis of Geographical Information Systems and their influence on agenda-setting and policy design best, and what does this position mean for the research?

In order to answer this question first technological reality will be looked at. This will be done by explaining the different positions in the technology debate. It is important to discuss the technology debate while ones position taken in the technology debate determines how one perceives technology and thus GIS. This because the way GIS are perceived will also reflect on the way they are able to influence agenda-setting and policy design. It is important to know where one stands regarding values and norms embedded in technology, autonomy of technology or the relation between humans, society and technology. This will make sure the influence of GIS on agenda-setting and policy design can be understood within the approach chosen. After elaborating on the different positions within the technology debate it will be argued that the position of social construction of technology will be chosen as the dominant position by which this research will be conducted. The choice for this position will be argued and justified; at the end of this chapter some conclusions will be drawn.

3.2 THE TECHNOLOGY DEBATE

The technology debate is an ongoing debate in philosophy of science as well as in sociology and technical studies. The technology debate revolves around technology and humans, technology and society and technology itself. It reflects on questions of whom drives technology, are humans the drives of technology, or does technology drive humans? Does technology possess any values of its own and are these values given to technology by humans or does technology have no values whatsoever and is it completely neutral? What is the relationship between technology and society, does technology constitute society or is it the other way around?

A large number of authors have described the technology debate and placed their opinion (see: Smith & Marx, 1994; Scharff & Dusek, 2003; Kaplan, 2004)

In the technology debate several issues are discussed. A central issue is who masters the other, are humans master over technology, or does technology control humans. Another key theme is the question whether technology is autonomous and determines its own causality. Another key feature is whether technology incorporates values or should be seen as neutral. Finally the relationship between technology and society is important, which drives the other?

Within the technology debate four positions can be identified, technological instrumentalism, technological determinism, social construction of technology and information ecology. Below each position will be elaborated on and the key features will be explained.

3.2.1 Technological Instrumentalism

The first approach to be dealt with is technological instrumentalism. Several authors have contributed in developing this approach (see: Noble, 1999; Postman, 1992). In this approach technology is seen as a neutral and value free tool. This means a number of things. Firstly that the technology can be used to any end. Secondly this means that technology is indifferent to politics. The technology can simply be used in any social or political context since it is not intertwined with any context. Thirdly technology is viewed as being rational. It is based on causal propositions; it can therefore be transferred into any other context as well. Finally technology is seen as universal, it stands under the same norm of efficiency in any and every context (Feenberg, 1991). In Feenberg's words:

> "A hammer is a hammer, a steam turbine is a steam turbine, and such tools are useful in any social context" (Feenberg, 1991. p. 5)

Within the approach of technological instrumentalism technology is not attributed with any agency. This means that technology itself cannot account for any form of causality, humans cause this causality. Technological progress therefore is viewed as desired progress since it is the human actor who pursues it (Bekkers et al., 2005).

Technology is developed and implemented with the purpose of achieving one's goal and the technology serves as a mean to achieve this goal. This means that humans become the user, the controller and the master of technology. Humans therefore determine the technological progress, the scope and the role of this progress. The progress that occurs is, within the approach of technological instrumentalism, always intended progress. It must be noted that the same technology can be used in different ways by different actors. Within technological instrumentalism this can be explained by the reasoning that technology is merely a tool and can therefore be used for different purposes (Van de Donk & Depla, 1994).

The relationship between technology and society within the approach of technological instrumentalism is unambiguously. Technology is seen as integrated into culture since its sole purpose is to help the user achieve his goals. Technology therefore does not interfere with the dignity or integrity of the culture in which it is introduced (Postman, 1992).

Critique

The approach of technological instrumentalism has received some critique over the years. This critique is mostly directed at the point within the viewpoint of technological instrumentalism in which unintended and unforeseen instances, when using technology, cannot be explained. Since technology will serve the intention of the user technological instrumentalism cannot explain why unintended consequences could occur (Zuboff, 1984; Ellul, 1990).

Secondly it is argued that technological instrumentalism regards humans as rational actors who are able to decide what they want to achieve. Also they have the skills and the knowledge to use the appropriate technology to achieve their goals. The viewpoint of technological instrumentalism can therefore not account for a scenario in which humans are unclear of their goals and unaware of the technological possibilities to achieve these goals (Simon, 1976; Zuboff, 1984).

Thirdly technological instrumentalism cannot account for the different effects and consequences the same technology produces in different cultures. If the intention of the user would be the same, the result should be the same as well regardless of culture according to technological instrumentalists. In practice this is not the case (Ellul, 1964).

Geographical Information Systems and Technological Instrumentalism

When viewing GIS in this approach this would mean that GIS are nothing more than a tool, to be used in anyway we please. When used GIS will, if used correctly, account for the outcome and the consequences the user intended. The desired effects of GIS as discussed in the previous chapter could then occur because we use GIS in a manner so they will occur. GIS in itself would be neutral and would not have any predetermined effect.

3.2.2 Technological Determinism

A second approach in the technology debate is technological determinism. A number of authors have contributed to the approach of technological determinism (Ellul, 1954; 1990; 1995; Zuboff, 1994; Heilbroner, 1967; 1994; Winner, 1977; 1980; 1983; 1993;). Contrary to technological instrumentalism, this approach holds that technology is not neutral or value free. Technology can be good or bad or a mixture of both, this goes for effects as well as consequences. These consequences may not be dependent on the desired goal but are dependent on the technology (Frissen, 1996). Technological development therefore does not depend primarily on the intention of the user but is fixed within the technology itself, it is inevitable and cannot be steered or controlled by humans (Ellul, 1990; 1995; Bimber, 1994).

Agency here is not given to the human user but is attributed to technology. It is argued that certain political and social norms and values are hidden inside the technology. Therefore the technology will bring about consequences according to these norms and values (Van de Donk & Depla, 1994). The outcome of the implementation of technology is therefore fixed and the consequences of the use of the technology cannot be traced back to the intention of the user (Bekkers et al., 2005).

> "And as technology 'develops' we adapt, because there seems little else to do. These everyday observations of how technology seems to 'determine' our behavior easily leads to the attribution of agency to the technological artifacts themselves." (Hoff, 2000, p. 13)

The relationship between technology and society differs from the approach of technological instrumentalism as well. In technological determinism the position is held that technology shapes the world (Zuboff, 1988). The nature and the characteristics of technology determine the societal consequences (Bekkers et al. 2005; Van de Donk & Delpla, 1994; Ellul, 1954; 1990). Therefore technology can account for certain behavior in society and organizations like for example forms of standardization or discipline (Beniger, 1986; Frissen, 1989).

The relationship between technology and society can be characterized by five characteristics. Firstly automatism, this holds that the choice for a certain mean to reach a goal is done by technology and not by humans. This is so because technology will destroy any non-technological activity like for example emotion. A second characteristic is self-augmentation, this means that technology is moving forward and developing itself, leaving humans powerless to stop this. Technical progress is irreversible and one new development will automatically lead to many more new developments. Thirdly monism must be dealt with, technologies are not individual but are part of a technical complex and all technologies are interconnected. This implies technology can have a completely independent technical morality. A fourth characteristic is technical universalism. This means that technology is intertwined with all elements of a culture and therefore cannot be seen apart from culture or society. Finally autonomy is dealt with; technological determinists argue that technology is autonomous to politics, morality and spiritual values. This autonomy is dominant over human autonomy. Technology has become the judge of what is morally just; it is the creator of a new morality (Ellul, 1964).

Critique

Technological determinism has received a large deal of critique over the years, mostly from the advocates of the approach of social construction of technology, which will be discussed below. A first critique point is directed at the idea that the nature and the direction of technological change are predetermined and unproblematic. This relates to the point where technological determinists attribute almost all agency to technology, leaving humans without agency. A large number of authors have criticized technological determinism for this, proving their point with a number of case studies (Williams & Edge, 1996).

A second core theme in the critique on technological determinism is the viewpoint that technology is not neutral. Especially social constructivists claim humans are the sole attributer of values and norms and technology cannot have these values in its own (Bijker, 1995; Wajcman, 2002; Orlikowski, 1992).

Geographical Information Systems and Technological Determinism

Within the approach of technological determinism as described above, it would be apparent that the widespread use of GIS would be inevitable, this because GIS would drive itself. Furthermore, GIS would not be neutral but would have some values embedded in itself. The outcome of the use of GIS would be fixed and inevitable and could not be steered by any human. The potential qualities and functions of GIS would be inevitable but so would also be the limiting factors. GIS used in public policy will inherently hold some political values and therefore will make sure of certain outcomes. Technology has the power to "reorder the rules of the game and thus our experiences as players" (Zuboff, 1988. p. 389).

3.2.3 Social Construction of Technology

A third approach in the technology debate is social construction of technology; this approach, in a lot of ways, contradicts the approach of technological determinism. A large number of authors have contributed to forming this approach (see: Bijker, 1995; Williams & Edge, 1996; Orlikowski, 1992; 2000; Orlikowski & Gash, 1994; Pinch & Bijker, 1984; Wajcman, 2002; Latour, 1990). Central to this approach is that choices need to be made in the design and the direction of technology. Economy, society, institutions and culture shape the direction and scope of technological development, the form of technology, the practice and the outcome of technological change (Williams & Edge, 1996).

Agency in this approach is given back to humans. Technology is not seen as autonomous, nor does it have a fixed outcome with inevitable consequences. All technology is seen as a human construct and is thus shaped, or made by humans. This is different from the approach of technological instrumentalism since there it is believed that technology is a tool, not an object of social construction. In social construction of technology the core idea is that humans shape reality, reality becomes how humans view this reality and the reality of technology is how it is perceived by others (Bijker, 1993; 1995; Hoff, 2000).

> "The question of what 'reality' is then becomes a question of with how many other people we share the same interpretation, or, put differently, a question of the social context and the social interactions in which we find ourselves. If we accept this argument, technology cannot be regarded as a 'given' (as in technological determinism), but must be seen as socially constructed like all other social phenomena." (Hoff, 2000, p. 14.)

The process of shaping technology proceeds along a number of steps. First of all the relevant social groups must be identified, these are the groups which design, implement, use or experience the consequences of technological developments. These groups carry the process of technological development (Bijker, 1995).

> "Technological developments should be viewed as a social process, not an autonomous occurrence. […] relevant social groups will be the carriers of that process."(Bijker, 1995, p. 48.)

These groups then give meaning to technology, making the technology into a technological artifact. This makes sure technology is never autonomous; the artifact must be seen as they are viewed by the relevant social groups, in terms of problems and solutions. Each relevant social group can give a different meaning to the same technological artifact. The artifact is constituted by this meaning (Bijker, 1995).

> "Relevant social groups do not simply see different aspects of one artifact. The meanings given by a relevant social group actually *constitute* the artifact. There are as many artifacts as there are relevant social groups; there is no artifact not constituted by a relevant social group." (Bijker, 1995. p. 77)

After a technological artifact had been given meaning and thus is constituted stabilization can occur. This means that within the relevant social groups the members begin to agree on what the meaning of the artifact is. After this closure on the meaning of technology can occur. Consensus on the meaning of technology between groups is established making sure all relevant social groups give the same meaning to the artifact (Bijker, 1995). In this process of reaching consensus, power is an important concept; the amount of power each relevant social group holds determines which meaning of the technology becomes dominant. In this way the meaning of a specific technology, how this meaning is accepted in society and gains stability is partially dependent on the power relations between the relevant social groups (Bijker, 1995).

What is very important in understanding the approach of social construction of technology is the technological frame. This technological frame consists of goals, problems, problem solving strategies, requirements to be met by problem solutions, current theories, tacit knowledge, testing procedures, design methods and criteria, users practice perceived substitution function and exemplary artifacts (Bijker, 1995). The technological frame is thus the set of rules, ideas and meanings within a group and it determines the interaction between the members of a group. This means the technological frame determines which meaning a group will attribute to a technology (Bijker, 1995).

Critique

The main critique points directed at social construction of technology are threefold. Firstly the concept of relevant social groups is contested. According to some it is fuzzy, at best, how to determine of whom the relevant social group consists. Furthermore, the idea of relevant social groups assume that all relevant groups can exert influence on the design process of the technology while in practice some groups do not have this power (Winner, 1993; Klein & Kleinman, 2002).

A second major point of criticism is that some, mostly the technological determinist, feel like the approach of social construction of technology is too agency centric, and does not place enough emphasis on the technology itself. The approach of social construction of technology overemphasizes the actor perspective. Therefore it cannot account for some actors not consciously joining the process of developing and implementing technology and just go along (Hoff, 2000; Klein & Kleinman, 2002).

Finally one of the core themes of critique is that social construction of technology understands the dynamics of society and technology in terms of needs, interests, problems and solutions, and completely disregards culture and structure (Winner, 1993). It must be mentioned here that this problem is recognized within social construction of technology and several authors have made efforts to incorporate structure (Orlikowski, 1992; Weick, 2001).

Geographical Information Systems and Social Construction of Technology

When regarding GIS in the light of social construction of technology it becomes clear that GIS do not have any values embedded in themselves but that the value any GIS application holds is shaped by humans. GIS and its meaning thus become a construct of society. This means that the potential qualities and functions GIS are said to have might occur but only if the GIS application is shaped to do so. Additionally the limiting factors for this potential might occur as well, depending on the shaping of the GIS application.

A GIS application might be attributed with different meanings and therefore might serve different functions and consequences for different groups.

3.2.4 Information Ecology

The final standpoint in the technology debate is information ecology. In this approach the question is less about whom holds agency but more on the influence of context. Within this approach society is seen as an ecology. Effects of technology therefore can only be understood when interaction between actors and the technology is viewed in their own specific and local environment. In the ecology there are interrelationships and interdependencies among different parts of the system. If one part of the system changes, all other parts are affected. This systemic change will come about since the system is dynamic and will coevolve (Nardi & O'Day, 1997).

Technological developments are not seen as neutral and value free, these values are shaped by humans and the technology itself. This means there is some social shaping as in the social construction of technology approach, but there are also some values embedded in the technology, as in the technological determinism approach. The emphasis is on choice. The use of a particular technology is always a political or social choice and that choice determines access and use (Bekkers & Homburg, 2005; Nardi & O'Day, 1997).

Neither technology nor humans are thus seen as autonomous or as given, humans decide the direction of technological development; people therefore master technology while technology still holds a certain amount of influence. This is consistent with the emphasis on coevolution, mutual shaping and interdependency in the ecology (Davenport, 1997).

The relationship between technology and society is already established through the ecology line of thinking. Here it is important to stress that all interactions and all mutual shaping takes place within a specific cultural, political, intellectual and economic environment (Bekkers & Homburg, 2005). This means that:

> "technology is not given, but that it is influenced by the characteristics and dynamics of the environments in which it has been developed, introduced and used. No technology, however autonomous it may be, can develop outside a given economical, political and intellectual context. But the converse also applies: characteristics of the technology also influence the environment." (Bekkers & Homburg, 2005 p. 13)

Critique

The approach of information ecology is clearly a reaction to technological determinism and social construction of technology and their critics. However, the approach of information ecology has been criticized itself. The main critique is directed at the biological metaphor. It would seem the ecology would be a harmonious concept and room for conflict would be minimized, in practice this cannot be found. Secondly the emphasis on the ecology accounts for a lack of actor perspective and therefore the shaping of the technology cannot be explained properly. Finally in the approach of information ecology it is believed that actors partially shape technology but attention for the different meanings different actors attribute to the technology is lacking (Bekkers & Homburg, 2005).

Geographical Information Systems and Information Ecology

Finally viewing GIS in the information ecology approach it is to be seen that GIS, like all other technologies is part of the ecology. GIS will coevolve with its users, designers, culture and so further. The potential functions and effects GIS are said to have might occur but this depends on the interactions within the ecology. This also counts for the limiting factors. While GIS can influence the ecology the ecology will also influence GIS. Therefore, the values GIS might hold are not fixed and at least partially subject to human shaping.

3.3 SOCIAL CONSTRUCTION OF TECHNOLOGY AS DOMINANT APPROACH

When looking at all the four approaches within the technology debate discussed above, three key characteristics within each approach stand out. Firstly who holds agency, humans, technology or both, secondly whether technology is neutral or not and thirdly how the relation between technology and society can be characterized. In table 3.1 these characteristics are briefly stated for each approach.

Table 3.1: Positions in the Technology Debate

	Agency/Autonomy	Neutrality	Relation to society
Technological Instrumentalism	Technology is not autonomous but a tool used by humans. Humans hold all agency.	Technology is neutral, since it is dependent on use it does not hold any value in itself.	No relation, technology can be used in any context as the user pleases.
Technological Determinism	Technology is autonomous and holds agency.	Technology holds values and morality, this is embedded within technology.	Society is steered by technology.
Social Construction of Technology	Technology is shaped by humans and is therefore not autonomous. Humans hold agency.	Technology is neutral but is attributed with values by humans in the process of shaping.	Technology does not drive society but once shaped by society the artifact can influence society.
Information Ecology	Technology is shaped by humans but at the same time holds some autonomy. Agency is mixed.	Technology has some values embedded in itself and for the other part the values it holds are shaped by humans.	Technology and society are part of the same system, they coevolve.

As already mentioned in the introduction of this chapter for this research the position of social construction of technology is chosen as the dominant view on technology and its relation to humans and society. The reason for this choice can be found in the main question of the research as well as in the empirical evidence found in other case studies regarding GIS and public policy as outlined in chapter 2.

First it is important to look at the focus of the main question in this research. This main question does not only deal with the influence of GIS on the course, content and outcome of processes of agenda-setting and policy design but the emphasis is on the influence of the use and perception of GIS on these processes.

When looking at the main question from a technological instrumentalist viewpoint the answer would be simple. The perception of GIS would not have any influence only the use would. When GIS would be used correctly it would serve the intention of the user. When GIS is regarded as a tool in this way the complexity of the processes of agenda-setting and policy design would not be done justice. Furthermore applying a technological deterministic viewpoint would cause the answer to the main question to be clear cut as well. The influence of perception and use would not exist. The influence of GIS on the processes of agenda-setting and policy design would be fixed and not dependent on use or perception. Additionally, the influence of GIS would be predetermined and given in any and all case studies since the values leading to an outcome would be embedded in GIS technology itself. This, like for technological instrumentalism, would not do any justice to the complexity of processes of agenda-setting and policy design. Both the approaches of technological instrumentalism as well as technological determinism do not fit the epistemological assumptions of the main question.

Both the approaches of social construction of technology as well as information ecology would do justice to the complexity of both processes. They can both account for a way of looking at technology which can help answering the main question of this research. Since in both approaches technology and thus GIS is shaped, to a more or lesser degree, the perceptions of actors are considered and the outcomes are not fixed.

Secondly the existing empirical material on GIS in public policy as presented in chapter 2 should be taken into account. Here it is seen that GIS is said to have a potential for public policy, but this potential is not always reached (Bekkers & Moody, 2006). Furthermore there are some limiting factors and unintended consequences as well (Bekkers & Moody, 2006).

This empirical evidence suggests that a technological instrumentalist viewpoint would be inaccurate, since GIS should not be able to have unintended consequences and should always fulfil potential when used correctly. Since GIS in this approach is nothing more than a tool, it could be used for any outcome, so also for the outcome in which the complete potential is used. The empirical evidence also suggests that a technological deterministic viewpoint could not do the trick. In several cases different outcomes are to be witnessed. If GIS would indeed hold values in itself and would predetermine outcomes, what then explains the difference in outcomes? Furthermore a number of case studies demonstrate that humans do have a large degree of agency and thus master technology (Carver et al., 2000; De V. Borges, 2000; Lips et al., 2000; Moukomia, 2004; Overchuk et al., 2004).

When looking at the empirical case studies done by different authors again the conclusion can be drawn that other approaches, social construction of technology and information ecology, could possibly fit the empirical reality.

The prime question then becomes, why choose social construction of technology over information ecology. The answer to this is to be found in the relation between technology and society. Where social construction of technology assumes that first technology is shaped and after closure on the meaning of technology occurs it will influence society by the meaning it has been given, information ecology does not assume chronological order. Information ecology assumes the influence between society and technology coevolves and that mutual shaping occurs.

When looking by the viewpoints of information ecology this would mean that GIS, next to being shaped, would start shaping society the moment it came into existence. The existing data in conducted cases suggests that the moment GIS was implemented, groups had an opinion of GIS, attributed meaning to the GIS application. The given meaning influenced their actions and interactions, not the GIS application itself (Lips et al. 2000; Overchuk at al. 2004; Turner & Higgs, 2003). This corresponds with the social construction of technology approach, claiming that all relevant groups give meaning to technology and act accordingly. It must be said however, that even though these actors have not in first instance influenced the application itself, in later stages some renegotiation does occur.

It is important to keep in mind that in this research the processes of agenda-setting and policy design hold a central position. In these processes the number of actors involved is very large. The negotiations on a certain agenda-point, a certain policy problem or different alternatives are characterized by political actions. Since agenda-setting and policy design processes are characterized with political motives, technology must be looked at accordingly. Therefore social construction of technology fits this research best.

The choice for social construction of technology will be used to analyze the cases in a later stage and will also be used to construct the conceptual frameworks of agenda-setting and policy design in chapter 6. Furthermore, this choice has some methodological implications which will be elaborated on in chapter 6 as well.

3.4 CONCLUSION

After looking at GIS in the previous chapter from a very rationalistic viewpoint, what can they do and how can they be used this chapter has looked at technology on a higher level. The relationship between technology, and thus GIS, and humans and society has been looked at. When doing so it has become clear that four positions are dominant in the debate on what the relationship between technology, society and humans is. The first viewpoint discussed was technological instrumentalism in which technology is seen as a tool that can be used to serve the users intention. Secondly the approach of technological determinism was elaborated on. It became clear that within this approach technology is attributed with agency and is regarded as holding values of its own. Technology cannot be steered or directed. Thirdly social construction of technology was discussed, here technology is seen as a social construct and humans have shaped the technology into what is has become. Finally information ecology has been elaborated on and it was explained that in this approach technology and society are intertwined like a biological ecology, influencing each other.

Furthermore it was argued that when looking at GIS the viewpoints of social construction of technology would be the most fitting viewpoints. This because firstly the main question of this research demands for an approach in which perception is not only emphasized but can also be explained according the same lines of the approach. Furthermore, social construction of technology is able, contrary to technological determinism and technological instrumentalism to account for the complexity of the processes of agenda-setting and policy design. Secondly social construction of technology is the most fitting viewpoint since empirical evidence suggests so. Social construction of technology can account for the potential enhancing qualities and effects of GIS. Also GIS can offer an explanation why these qualities and effects do not occur every instance. The same goes for the limiting effects GIS can have. Technological instrumentalism and technological determinism cannot do so. The reason then that social construction of technology is chosen as dominant viewpoint in this research over information ecology can be justified by chronology. While information ecology assumes that technology influences society right away through its embedded values, social construction of technology assumes that technology can only do so after it is shaped, with the values given to technology in the process of shaping. Empirical case studies support the latter.

This means that technology, GIS, society and humans as well as the processes of agenda-setting and policy design, with their course, content and outcome, in this research will be looked at from a social construction of technology viewpoint. This will come back in the construction of the conceptual frameworks. This will have some methodological implications which will be elaborated on in a later chapter.

Chapter 4

Setting the Agenda

4.1 INTRODUCTION

There are a large number of issues relating to public policy influencing everyday life, some on an individual scale and some on a more collective level. Not all of these issues are discussed in politics, because time is pressing, because administrators and politicians are not aware of the existence of an issue or because some try to make sure they are not discussed. When an issue is not discussed this means it is not on the agenda. The goal of this chapter is to answer the first part of sub-question three: What is agenda-setting and policy design, what do existing theories on both processes entail and how can these existing theories help to research the influence of the perception and use of Geographical Information Systems on these processes? In this chapter this will be done for agenda-setting. Policy design will follow in chapter 5.

This chapter is about the agenda, which issues are on the agenda, how they got there and how they would potentially get there and the process by which this happens. Addressing this process of agenda-setting is very important to the main question of this research. This chapter will first of all start with explaining what an agenda is and what agenda-setting means. This is of importance since one clear definition of agenda-setting is needed in order to understand the process and relate to the main question. Secondly several theories of agenda-setting will be discussed and explained. There are a large number of theories on agenda-setting but only four will be discussed. The four theories of agenda-setting that will be elaborated on are those theories that hold, by looking at existing literature on GIS, a large ability in explaining the influence of the use and perception of GIS on agenda-setting. Finally at the end of this chapter some conclusions will be drawn and a summary will be given.

First it is important to look at what agendas actually are and what agenda-setting really is and how this should be viewed within this research.

4.2 AGENDA-SETTING

There are a lot of different ways to attract attention to a perceived problem, subject or issue. One could write a letter to ones political representative, one could write a letter to the opinion section of a newspaper or one could go on the internet to find support. The goal of this would be to change the existing situation into a more preferable situation for the person perceiving the existing situation as troublesome. But before even thinking about changing the existing situation by making new policy one would first have to get politics to be aware of the issue and discuss it. In other words, one would want to place the issue on the agenda.

There exist a large number of different definitions of what an agenda is and of what agenda-setting is (see: Kingdon, 1995; Rogers et al., 1993; Sabatier & Jenkins-Smith, 1993; Cobb & Elder, 1972; Kosicki, 1993).

Some authors distinguish between different types of agendas like the public agenda, the policy agenda or the media agenda (Dearing & Rogers, 1996). The media agenda is the agenda in which the issues and subjects are listed that are on the agenda of the mass media. The public agenda holds all the issues and subjects on which the public is involved. These are those subjects that are spoken of in ones living room but also those issues for which the public might undertake action. Finally there is the policy agenda and this agenda holds the issues and subjects to which policy-makers devote their attention to. These different agendas can overlap but an issue that is on one of the agendas is not necessarily on the other two (Dearing & Rogers, 1996). Because of the focus of this research and the main question, in this research only the policy agenda will be looked at.

One of these definitions of an agenda must be chosen in order to come to an understanding of how an agenda is viewed in this research; this is needed in order to construct the conceptual model and to understand the case studies. One of the definitions of an agenda stands out and incorporates exactly what in this research should be viewed as an agenda and is thus correspondent with the notion of a policy agenda. This is Kingdons definition, this definition is very elaborate and unambiguously, furthermore this definition can be used with all the theories of agenda-setting that will be used in construction the conceptual model. The agenda in Kingdon's definition is:

> "the list of subjects or problems to which governmental officials, and people outside of government closely associated with those officials, are paying some serious attention at any given time." (Kingdon, 1995. p. 3)

This means the agenda only incorporates those subjects to which attention is paid by government or those closely related to government.

This definition of the agenda makes room for a definition of agenda-setting. Agenda-setting can be defined as the process of getting a subject or a problem to gain this attention from government or those closely related to government. This implies a number of things. Firstly that the agenda is made up out of a number of subjects and that agenda-setting is about including a certain issue to this list of subjects up for serious attention. The definition also implies the agenda status is not obtained when a subject obtains a lot of attention from a large group of the public. The agenda status will only be obtained when the government or those related with the government pay attention to the subject. This is what corresponds with Roger's definition of policy agenda-setting, contrary to media agenda-setting or public agenda-setting

> "Media agenda-setting includes those studies that conceptualize the mass media news agenda as the main dependent variable of study. Public agenda-setting includes those studies that conceptualize the relative importance of issues to members of the public as the main dependent variable of study. Policy agenda-setting includes those studies that conceptualize the issue agenda of governmental bodies or elected officials as the main dependent variable of study." (Rogers et al., 1993. p. 69)

After the definition of agenda-setting is chosen different theories of agenda-setting can be discussed in order to come towards an understanding of agenda-setting but also in order to look at the potential for explaining the influence of the perception of GIS on agenda-setting.

4.3 THEORIES OF AGENDA-SETTING

After accounting for a useful definition of agenda-setting it is important to look at how the process of agenda-setting actually proceeds. There are a large number of different theories on agenda-setting that will not all be discussed. Only four of those theories will be discussed below. These theories include the barrier model (Bachrach & Baratz, 1970) the Cobb and Elder model (Cobb & Elder, 1972), the stream model (Cohen et al., 1972; Kingdon, 1995) and the advocacy coalition framework (Sabatier & Jenkins-Smith, 1993). The choice for these theories instead of any other theory can be justified by taking into account that based on the literature on GIS. These theories can be useful in explaining the influence of the perception and use of GIS on public policy.

It must be mentioned that the order of these theories is not random, they follow each other chronologically. The first theory, the barrier model, is a reaction to previous theories of agenda-setting. Before the 1960 agenda-setting research was mostly dominated by a pluralist approach. It was believed that participation in the political system was open to all and that power was widely distributed. Agenda-setting was driven by public demands and opinions (Parsons, 1995). This was challenged by Bachrach and Baratz who claimed that this was not the case and the system held an inherent bias against some issues (Bachrach & Baratz, 1970). The Cobb and Elder model, which will be discussed after the barrier model was a reaction to this pluralist thought as well. In the barrier model the focus is on the bias against some issues, in the Cobb and Elder model the idea of participation for all was contested (Cobb & Elder, 1972). The next theory which will be discussed is the stream model. This model does not fall within the pluralist tradition either. It is however a reaction to theories like those made by Bachrach and Baratz and Cobb and Elder. This can be seen for two reasons. Firstly the stream model turns its back on the stage heuristic, the idea that policy-making occurs in fixed steps or stages. Secondly it does not focus on the limitations of participation or the bias in the system but the model focuses itself on what makes an issue an issue and at which point in time the issue is addressed (Kingdon, 1995).. Finally we will deal with the advocacy coalition framework. Like the stream model the advocacy coalition framework moves away from the pluralist tradition as well as the stage heuristic. The advocacy coalition is a reaction to the stream model in some ways. (Sabatier, 1990) The main difference is that the advocacy coalition framework assumes ideas, analysis and information are part of the political stream and the major force for change. The stream model does not see it this way and assumes the analytical stream and the political stream converge and that the convergence is the force for change (Parsons, 1995).

It must be noted before moving on to the separate theories, that the theories discussed below entail much more than will be discussed; some of these theories deal with the entire policy process and not only with agenda-setting. Only those parts of the theory will be discussed that deal with agenda-setting.

4.3.1 The Barrier Model

The first model to be discussed is the barrier model, developed by Bachrach and Baratz in their book 'Poverty and Power' (Bachrach & Baratz, 1970). The model is far more than just a model of agenda setting and looks at the whole process of policy making in a linear matter. Since this model in this research will only be used for its dealing with agenda-setting only this part of the model will be discussed. Graphically the model is displayed in figure 4.1.

The theory starts of with power and the sources of this power. Power according to Bachrach and Baratz is regarded as something relative and only exists when exercised. The exercising of power will happen in conflicts of interest of values. Therefore there are several sources of power and these sources can be used by one actor to exert power over another actor. These sources entail first resources; these are the status of a group, its assets, its number of members, the ideology and the interests of a group. Secondly priority is important; this deals with cost-benefit analysis. An issue that is not of prime importance will not be spent a lot of money on in order to have it reached agenda status. Thirdly strategy, this relates to the goal of the actor, is the actor aiming for a decision on policy, so values are reallocated or is the actor aiming for a non-decision, making sure the status quo is maintained. Finally interaction is important, this deals with interaction between groups, they form alliances and coalitions, they can cooperate or conflict with one another (Bachrach & Baratz, 1970; 1963).

The next step in the model are the boxes listing the groups who are looking for change, those seeking reallocation of values. These can be the people who have a substantial interest in changing the policy and also have the capacity to do so, associations promoting

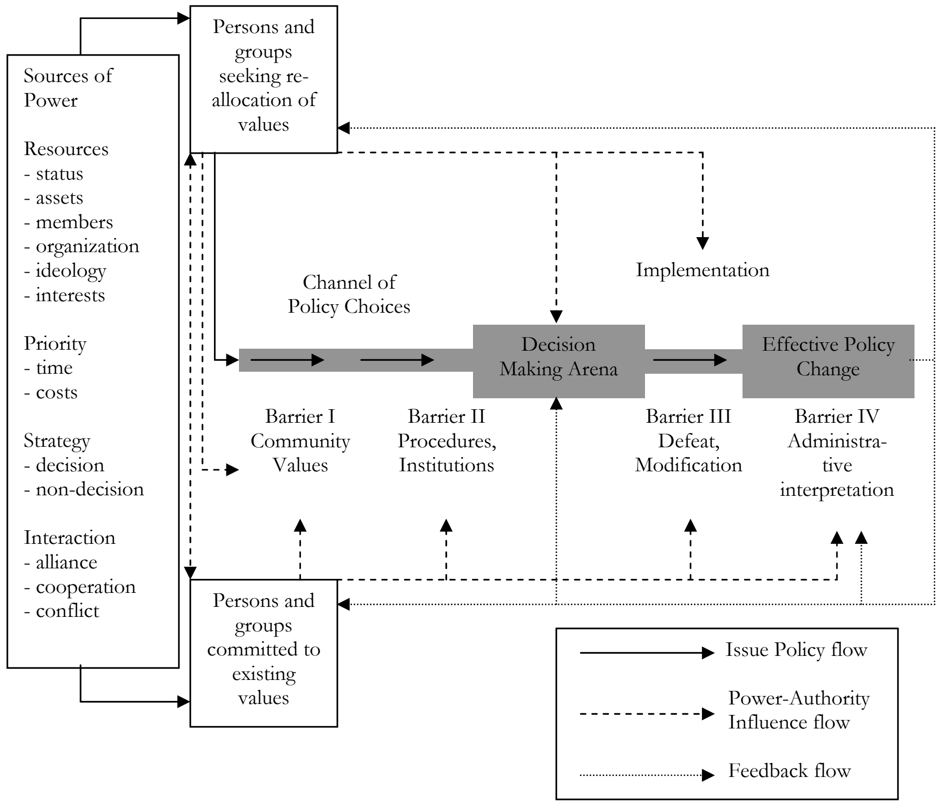

Figure 4.1: The Barrier Model (Bachrach & Baratz, 1970. p. 54)

specific interests and latent groups that are uninterested now but that are likely to become active in the future. Secondly there are the groups who prefer the existing situation, those committed to existing values. This group focuses on preventing the reallocation of values since they would like their preferred policy to maintain dominant. In the barrier model these two groups are in constant conflict trying to maintain or alter the existing situation (Bachrach & Baratz, 1970).

What is linked to the two groups, one in favor of change and one committed to the existing situation is the mobilization of bias (Schattschneider, 1960). The concept of mobilization of bias holds that dominant values and procedures operate in favor of some and to the disadvantage of others. On mobilization of bias it can be said that:

> "all forms of political organization have a bias in favor of the exploitation of some kinds of conflict and the suppression of others because *organization is the mobilization of bias*. Some issues are organized into politics while others are organized out." (Schattschneider, 1960, p. 71.)

Bachrach and Baratz use this concept in their model and claim that mobilization of bias should be defined as:

> "a set of predominant values, beliefs, rituals, and institutional procedures ('rules of the game') that operate systematically and consistently to the benefit of certain persons and groups at the expense of others." (Bachrach & Baratz, 1970, p. 43)

When then looking at the actual process of agenda-setting it is to be seen that the two groups will operate within the channel of policy choices. This channel contains every demand for policy change that receives public notice and provokes discussion so much the demand becomes an issue in the policy making arena (Bachrach & Baratz, 1970).

In this channel of policy choices only the group seeking change can influence the new issues, naturally since the group committed to the status quo would not want to bring in new issues and would try to prevent this.

In this channel of policy choices, an issue, once it has become an issue must overcome two barriers in order to reach agenda status. If the issue overcomes these barriers successfully the issue will be placed on the agenda. On each barrier the issue can either survive and move on in the channel of policy choices or die and cease to exist as an issue.

The first barrier an issue needs to survive in order to move on towards the next barrier to become an agenda point consists of values, beliefs and myths held by a dominant portion of the community. The purpose of this barrier is to make sure that issues that conflict fundamentally with prevailing norms will not reach agenda status and will thus die. Both groups can influence this barrier. The group seeking change will try to back the issue with a large amount of power and the sources of power they obtain, so it will pass the barrier. An issue backed with a lot of power is more likely to be seen as legitimate by a community. The group trying to maintain the status quo will do exactly the same; it will use all its sources of power to brand the issue as illegitimate or morally wrong, hoping that society will accept their views so that the issue dies at the first barrier (Bachrach & Baratz, 1970).

When the issue achieves to survive the first barrier it will have to move on towards the second barrier. This barrier consists of procedures, customs and organizational devices. This barrier can only be influenced by the groups committed to existing values. This can be explained by the idea that these groups are the groups influencing and guarding these procedures. In this barrier the groups committed to existing values can try to block issues they consider unwanted from reaching agenda status. They will use procedures and customs to make sure the issue does not pass the barrier, for example by stalling the issue so long that it is no longer relevant, or by communicating the issues to the wrong agency or department. If the issue manages to survive this barrier the issue has become an agenda point (Bachrach & Baratz, 1970).

The model moves on forward towards decision-making and implementation but since these stages are not relevant for this research they will not be discussed here.

When we look at the empirical evidence of the usability of this theory it can be found that the theory has been used to empirically evaluate case studies. One example is the research of Saggar (1991) who has researched why the issue of race was kept out of British policy. Saggar has used the barrier model to demonstrate how certain issues are organized out of politics in the first barrier. Saggar has concluded that because of a consensus in the 1960s race was excluded as issue in policy-making. Race specific policies remained unheard because they were branded as illegitimate and a threat to the established policy framework (Parsons 1995).

A second example in which the barrier model was used to evaluate a case study is the research conducted by Staudt and Jacquette (1988). In their research they look at the second barrier in the model. This is the barrier in which institutions can prohibit issues to obtain agenda status. The research deals with the question on why resources and values are unevenly distributed among men and woman. They claim this can be accounted for by institutional and bureaucratic inaction, avoidance and distortion (Parsons, 1995).

4.3.2 Cobb and Elder's Model

A second theory of agenda-setting is the model developed by Cobb and Elder in their book 'Participation in American Politics' (Cobb & Elder, 1972). This model, like the barrier model assumes the same linear way of policy-making, but in the Cobb and Elder model there is far more attention for the way an issue expands to a larger public.

In order to understand the model first the underlying propositions need to be understood. Firstly Cobb and Elder assume the system always holds an inherent bias and will serve in favor of some and to disadvantage of others, coherent with mobilization of bias (Schattschneider, 1960; Cobb & Elder, 1972). Secondly Cobb and Elder assume that the range of issues, thus the number of issues, which are considered, are limited. This is explained by taking into account that attention and capabilities of human organization are limited. Thirdly Cobb and Elder assume there is an inherent bias in favor of the status quo. Because of the systems inertia it is extremely difficult to change prevailing bias in terms of types of issues considered (Cobb & Elder, 1971). When looking at the model itself it can be graphically displayed as in figure 4.2.

In the model the attention is firstly directed towards the question what an issue actually is. This is defined as a conflict between two or more groups relating to the distribution of positions and resources (Cobb & Elder, 1972). Issues are seen as constructions, they can be manufactured because groups believe there exists an unfavorable bias in the distribution of positions and resources. Secondly groups could construct an issue for its own gain.

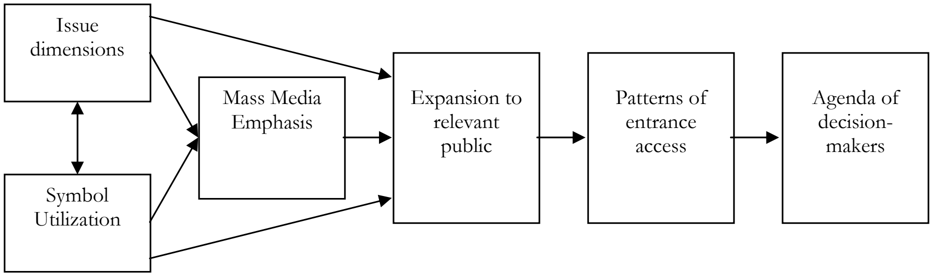

Figure 4.2: The Cobb and Elder Model (Cobb and Elder, 1972. p. 141 and 151)

A third way of constructing an issue is when the issue is initiated by unanticipated events and finally an issue can be generated by groups that believe they are serving the public interest (Cobb & Elder, 1972).

These initiators of the issue together with triggering mechanisms shape the issue. Triggering mechanisms can be internal, like natural catastrophes, human events like hijackings or technological change which creates questions not discussed before. External events include those events in which other countries come into the equation, for example, military violence or war (Cobb & Elder, 1972).

After the issue is created and shaped, proponents of the issue would want the issue to reach agenda status. In the Cobb and Elder model agenda status for an issue is solely dependent on whether the issue expands to a larger public and to which degree. Cobb and Elder state:

> "The greater the size of the audience to which an issue can be enlarged, the greater the likelihood that it will attain systemic agenda standing and thus access to a formal agenda." (Cobb & Elder, 1972. p. 110)

This expansion to a larger public can be divided into four different publics. Firstly the specific groups which are identification groups, these are the people who identify their interests with the group. They are the first segment of audience involved in a conflict in the case the issue would expand beyond the initial disputants. Secondly the specific groups which are attention groups, these are those people who do not identify with the group but with the interest at stake. These people belong within the first segment of audience as well. A third group is the mass public which is the attentive public. These are the informed and interested people. Finally the mass public defined as the general public might become involved; they are the last to be involved in conflicts (Cobb & Elder, 1972).

In the Cobb and Elder model the likelihood of an issue gaining agenda status depends on how far the issue is expanded. This expansion of the issue is not solely dependent on the content of the issue but on the nature of the issue. The nature of the issue can be characterized by five dimensions.

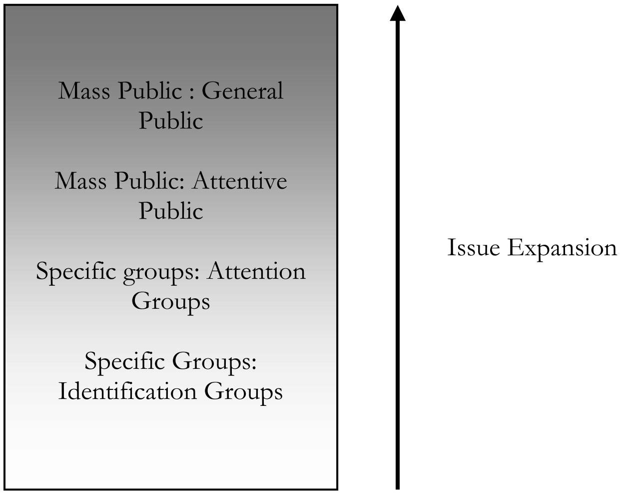

Figure 4.3: Expansion of an Issue

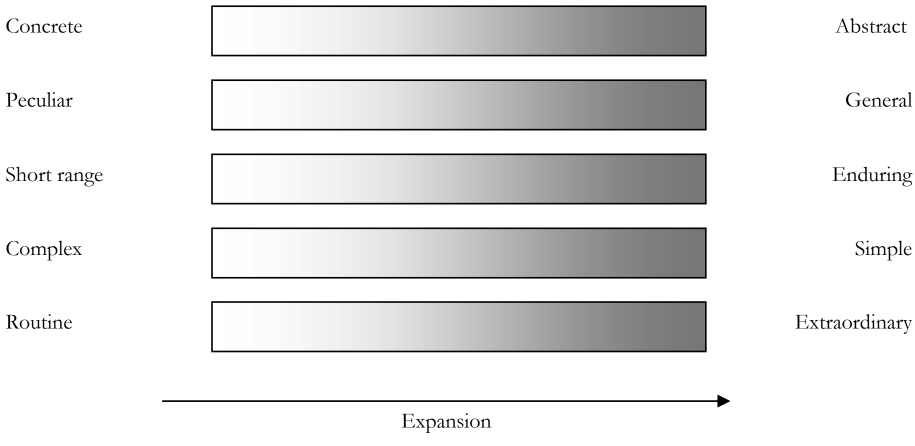

Figure 4.4: Dimensions of the Nature of the Issue

The first dimension deals with the degree of specifity of an issue. An issue that is very concrete will not gain attention from a large public while an issue that is very abstract will. This because a large group of people will find something within the issue they can identify themselves with. Secondly the dimension of the scope of the issue is important. An issue with general significance will expand more easily than an issue that is very peculiar. People will not identify with an issue not affecting them. A third dimension deals with temporal relevance. An issue that is only significant for the short run will not expand as easily as an issue dealing with the long run. Issues dealing with the long run will generally affect more people. Fourthly the dimension of the degree of complexity is important. A very complex issue will not be understood by a large public and will thus not expand very easily. Finally there is the dimension of categorical precedence, a routine matter will be resolved just like previous similar matters and will not attract a lot of public attention (Cobb & Elder, 1972).

When expanding the issue to a larger public the mass media become important. The media are able to activate latent supporters of an issue and they can provoke other groups in order to create sympathy for the initiators. The media can also discredit opponents or show demonstrations of strength of commitment (Cobb & Elder, 1972).

When the issue is then shaped and has expanded to a larger public it has to gain entrance to the agenda. Patterns of this entrance depend on to which degree the issue has expanded to a larger public. When the issue has not expanded beyond the identification groups or attention groups it is not very likely to reach agenda status. When the issue has expanded beyond the attentive public the issue has a fair chance of reaching agenda status with some lobbying. Finally when the issue has expanded beyond the general public it will automatically be granted agenda entrance (Cobb & Elder, 1972).

The Cobb and Elder model has been tested for its empirical use. A number of authors have used this theory to study case studies and explain occurrences.

One of these scholars is Outshoorn, in her 1991 study on affirmative action policy programs in the Netherlands, benefiting woman she has used the Cobb and Elder model to analyze the policy programs. In the research a six stage agenda cycle has been made: the pre-political, the voicing of wants, issue formation, decision-making, implementation and evaluation. The stage of the voicing of wants as well as the stage of issue formation relies heavily on the Cobb and Elder model. In her research she concluded that the issue of affirmative action has been modified, the original content has been diluted and lost scope. In terms of affirmative action the issue has been reduced. (Parsons, 1995)

4.3.3 The Stream Model

The third model of agenda-setting that should be addressed is the stream model. The garbage can model was originally developed by Cohen, March and Olson in their article 'A Garbage Can Model of Organizational Choice' (Cohen et al., 1972). This model has later been revised and adjusted by Kingdon in his book 'Agenda's, Alternatives and Public Policy' (Kingdon, 1995). Because Kingdons revision of the theory makes the model more useful for this research Kingdons version of the stream model will be used.

In order to understand Kingdons model of the stream model first some of the premises of the original model must be explained. It is important to understand that the stream model does not assume policy-making to proceed linearly. Policy-making is not seen as a process moving trough fixed stages as the two theories discussed above do; the stage heuristic is dropped in the stream model. Policy-making is seen as 'organized anarchy'. This organized anarchy can be characterized by three premises. Firstly by problematic preferences, this holds that an organization functions on the basis of inconsistent and ill-defined preferences and that there is no coherent structure. Secondly technology of the organization itself is unclear. This means that none of the members of the organization really understand its processes and the organization operates on the basis of trial and error learning. Thirdly an important premise is fluid participation, this means that members of the organization vary in the time and effort they devote to the organization, making the boundaries of the organization unclear and changing constantly (Cohen et al., 1972; Peters, 2002).

Kingdon in his revised model holds these premises. The model than assumes there are three different streams. These streams lie at the core of the stream model. The first stream is the problem stream. In this stream all possible perceived problems float around. These problems do not come to the attention of policy-makers on their own. Mostly they come to the attention through an indicator, for example through a monitoring program, the data presented by this program than constitute the problem. Next to the indicator, problems mostly need a focussing event to become noticed. This event needs to either reinforce the pre-existing perception of the problem or affect the problem definition. The problems in the problem stream are all up for agenda status. Each problem with its advocates will try to achieve agenda status (Kingdon, 1995).

The second stream is the policy stream. In this stream all proposals for policy float around. The number of proposals is indefinite and does not imply a rational decision-making system. In this stream policy communities must be looked at. These are communities composted of specialists on a subject who interact with one another. There can be specialists who advocate a certain proposal, they are called policy entrepreneurs. The entrepreneurs soften op ideas to the policy communities which tend to be resistant to change and inertia bound. Acceptance for certain ideas can be achieved by the policy entrepreneurs, even before these proposals obtain agenda status, making sure that when these proposals come up for agenda entrance the community is ready for them. In order for a proposal to stay in the stream it must be technically feasible, it must fit the values and ideology of the policy community and the greater public and there must be the belief the proposal will not cause more problems when it would be implemented (Kingdon, 1995).

The third stream is the political stream. This stream is made up out of three components. Firstly the national mood, this refers to the political climate in a country, it is the thinking of the general public along certain common lines. A change in this mood could affect the policy agenda dramatically. Kingdon states that:

> "is the notion that a rather large number of people out in the country are thinking along certain common lines, that this national mood changes from one time to another in discernible ways, and that these changes in mood or climate have important impacts on policy agendas and policy outcomes." (Kingdon, 1995, p. 146)

Secondly in this stream the organized forces, like lobby or interest groups are important. These forces can form coalitions and force the government to act upon their interests. Thirdly the government itself is part of the political stream. A turnover of administration can invoke that new items are considered (Kingdon, 1995).

What then constitutes for an issue reaching agenda status? At the time the three streams come together there is a possibility for an issue to reach agenda status. This means that a problem is matched to a solution or the other way around. Together with the right time in the political stream an issue can move forward towards agenda status.

> "solutions come to be coupled with problems, proposals linked with political exigencies, and alternatives introduced when the agenda changes." (Kingdon, 1995, p. 173)

An important concept here is the policy window. This is an opportunity for advocates of an issue to push their issue, problem or solution, forward. Such a window stays open only for a very brief time and mostly opens because of a change in the political or the problem stream. The national mood changes, the administration changes or a new problem captures the attention of the government. When this happens and the three streams come together an issue can be pushed forward and becomes an agenda point (Kingdon, 1995).

These three streams do not come together on their own, they are coupled. The one coupling the streams is called the policy entrepreneur. Policy entrepreneurs are advocates of an issue, they are willing to invest their resources to try and push an issue towards agenda status. They also, in the political stream try to soften up the system so the system will be ready for the issue as soon as the policy window opens. This makes sure the government is familiar with the issue and possibly willing to listen when the opportunity arises. The policy entrepreneur has mostly developed his ideas beforehand and waits until the policy window opens. At the time it opens it is the policy entrepreneur who links a problem to a solution and grabs the opportunity in the political stream. In this way he couples the streams so the issue can be pushed forward (Kingdon, 1995).

Even thought the stream model does not have any clear stages it has been used by scholars to examine case studies. In empirical reality the stream model has proven its value.

One of the scholars who used the stream model to analyze a case study is Mazur (1991). In her research she has looked at the French employment policy. The main question of the research deals with why equal employment policies for men and woman have not been incorporated into a general employment policy and why these policies are not enforced by courts. In the end she concludes this has happened because the streams were not successfully bundled together. The problem recognition, the policy propositions and the politics have not found each other in the right place and the right time. Therefore the equal employment issue has become a symbolic issue instead of a fierce agenda point. The issue, since being symbolic, has obtained attention it would otherwise not have gotten but for actual change it can be said that this would only be incremental (Parsons, 1995).

4.3.4 The Advocacy Coalition Framework

The final theory of agenda-setting to be discussed is the advocacy coalition framework. Sabatier and Jenkins-Smith developed this framework in their book 'Policy Change and Learning. An Advocacy Coalition Approach' (Sabatier & Jenkins-Smith, 1993). Like Kingdon and Cohen, March and Olson, in the advocacy coalition framework the stage heuristic is rejected as well and policy-making is not assumed to follow linear steps. Furthermore the framework leans on four basic premises. Firstly that the understanding of the process of policy change requires a decade or more. Secondly it is important that the focus when looking at policy change should be on the policy sub-system. The policy sub-system is the sphere in which actors from a variety of public and private organizations are actively concerned with a policy problem or issue. Thirdly the policy sub-system must include an intergovernmental dimension; all layers of government should be included in the sub-system. And fourthly, public policies should be conceptualized in the same way as believe systems, by sets of value priorities and causal assumptions (Sabatier, 1993). Graphically, the advocacy coalition framework can be displayed as in figure 4.5.

The framework starts with exogenous variables; these are the constraints and opportunities for the actors in the policy sub-system. These variables can be divided into those that stay stable over time and those that are dynamic, both of them will affect change in the policy sub-system. The stable variables include, the characteristics of a good affecting the problem definition, the basic distribution of natural resources, the cultural values and the social structure and the basic legal structure. The dynamic variables are made up out of the socio-economic conditions and technology, the systemic governing coalitions, the elected officials, and the impacts from other sub-systems which affect this sub-system (Sabatier, 1993).

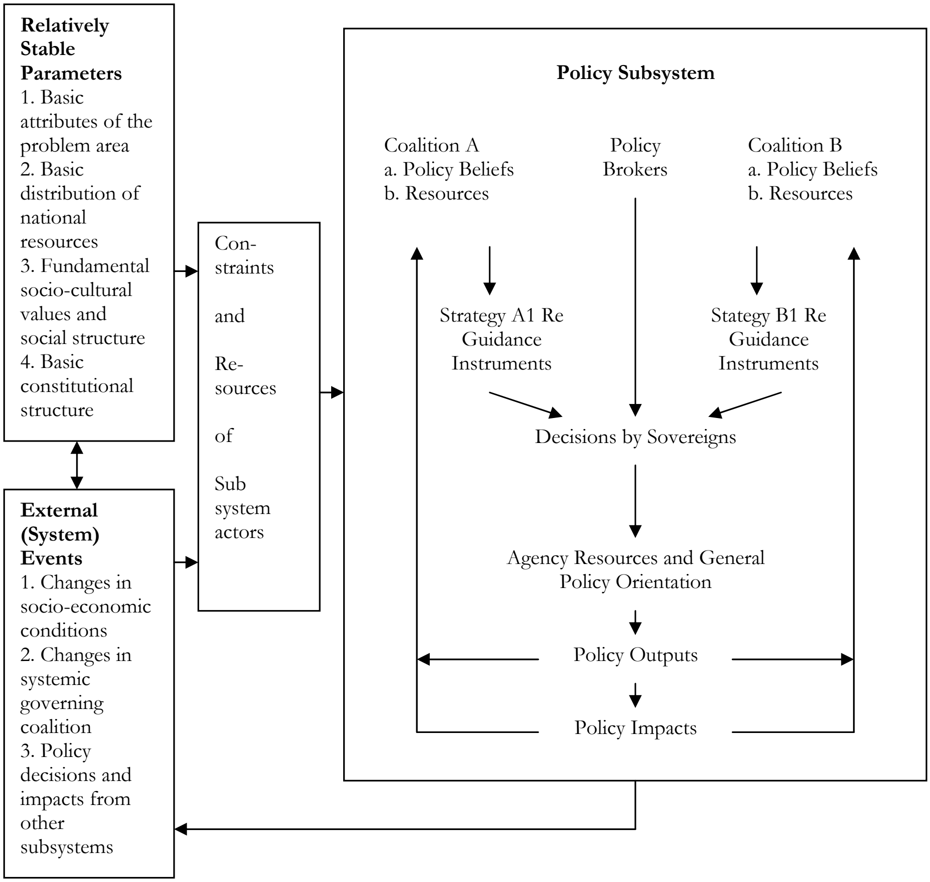

Figure 4.5: The Advocacy Coalition Framework. (Sabatier, 1993. p. 18)

The policy sub-system is composed of a set of actors dealing with a policy problem. The sub-system emerges when a group of actors become dissatisfied with the neglect of a problem by existing sub-systems, they address the problem by creating a new sub-system. These actors in the sub-system can be aggregated into advocacy coalitions. Advocacy coalitions are made up out of people with the same belief system. In Sabatier's words advocacy coalitions are:

> "composed of people from various governmental and private organizations who share a set of normative and causal beliefs and who often act in concert." (Sabatier, 1993. p. 18)

The goal of each advocacy coalition is to translate their belief into public policy, at the same time they are hindered by other coalitions that aim for a different policy on the same issue. When two or more advocacy coalitions reach a stage of conflict a policy broker will mediate the conflict making sure a reasonable compromise can be found (Sabatier, 1993).

What happens in seeking agenda status for an issue is that one advocacy coalition (A) perceives a problem affecting their core values, they would want to solve this problem and they will propose a solution. Another advocacy coalition (B) feels aggrieved by the proposal and will try to prevent this proposal from reaching agenda status. They could try to challenge the validity or seriousness of the problem, or question the technical aspects or institutional arrangements proposed. As a result of this coalition A will start a debate and will come into conflict with coalition B. Both coalitions want their idea reaching agenda status and will use their resources to obtain this. One coalition might become dominant and with the mediation of the policy broker their idea, maybe in toned down form or with elements of the preferences of the coalition B, will reach agenda status (Sabatier, 1993).

Many authors have tested the advocacy coalition framework for its usability in agenda-setting practices as well as in policy-making practices.

One of these is a study in applying the advocacy coalition framework to freight transportation in the United States by Stich and Miller. Here it is concluded that the advocacy coalition framework proves to be very useful in explaining the ongoing changes in the freight transportation arena. Furthermore the advocacy coalition framework, in this case, allows the authors to explain policy oriented learning as well as the involved belief systems in the arena. In terms of policy recommendations, the authors use the advocacy coalition framework to suggest the governing coalition in the freight transportation arena should be modified due to the competitiveness of the other coalitions (Stich & Miller, 2008).

4.4 COMPARISON AND OVERVIEW OF THE DIFFERENT THEORIES

Even though the four models discussed above can be compared on a large number of different points for the sake of this research this is not necessary. The different theories of agenda-setting will be used to come to a conceptual framework and therefore a thorough comparison is not needed. However, for the sake of oversight in the different theories a short comparison is useful. The different theories will be compared with one another on the basis of three points, their core concepts that are essential to the theory, the criteria for an issue to reach agenda status and the constraining factors of achieving agenda status for an issue. These points are outlined in table 4.1.

When comparing the core concepts of the different theories it can be noticed that in both the barrier model and in Cobb and Elder's model mobilization of bias has prime importance. Both theories deal with the idea that some interests are organized in, and

Table 4.1: Overview of the Theories on Three Points

	Core Concepts	Criteria Agenda Status	Constraints Agenda Status
Barrier Model	- mobilization of bias - power and conflict - values and beliefs - procedures	An issue must fit the dominant beliefs and values held by the larger public and pass existing procedures. This is determined by the amount of power groups hold.	An issue that does not fit the dominant beliefs and values of the larger public and an issue that is successfully blocked from official attention will fail to gain agenda status. This is dependent on the amount of power groups hold.
Cobb and Elder Model	- mobilization of bias - nature of an issue - expansion of issue - symbols - mass media	An issue must be expanded to a larger public. This is dependent on the nature of an issue, symbols and the media.	An issue fails to reach the agenda if it fails to expand to a larger public, dependent on the nature of the issue, symbols and the media.
Stream model	- independent streams of problem, solution and politics - national mood - policy window	An issue can be pushed forward when the streams come together and together with the opening of a policy window.	An issue fails to reach the agenda when coupling of the streams fail or when the policy window is closed.
Advocacy Coalition Framework	- policy sub-systems - advocacy coalitions - belief systems - conflict	An issue can reach agenda status dependent on the interplay between advocacy coalitions within the policy sub-system. When one becomes dominant its issue is placed on the agenda.	Failure to reach agenda status for an issue is dependent on the interplay between advocacy coalitions in the sub-system. If one coalition successfully blocks an issue it will fail to reach agenda status.

others are organized out of politics. The advocacy coalition framework deals with this as well although the term mobilization of bias is not mentioned.

In terms of power the barrier model and the advocacy coalition framework deal with this very explicitly. In the stream model power comes back in the political stream when the strength of the organized forces comes in. Cobb and Elder do not deal with power specifically.

Values and beliefs are important in three of the theories, in the barrier model it is stated that dominant values of the community need to match with the issue. In the stream model an issue must be viewed as acceptable in terms of values and the national mood refers to dominant values in society. In the advocacy coalition framework values and beliefs constitute the actions of each coalition.

Procedures are also important in comparing the theories. In the barrier these procedures account for a barrier and are thus of prime importance. In the stream model they are present in the political stream, in the advocacy coalition framework they are regarded as a parameter to constrain or enhance the room advocacy coalitions have for negotiation.

Only the Cobb and Elder model stress the importance of the nature of the issue compared with the stressing of the content of the issue as other theories do. Additionally this model is the only one in which expansion of the issue is emphasized and even the determining factor for reaching agenda status.

Summarizing it can be said the barrier model takes structure into account and deals with values very elaborately where Cobb and Elder's model takes the way issues are expanded into account. The stream models assumes problems need to be matched to solutions and with the proper political climate and the opening of a policy window agenda status could be reached. And finally the advocacy coalition framework deals with belief systems and the interaction between different groups to come towards agenda status.

In chapter 6 relevant concepts of these four theories will be used to construct a conceptual framework according the lines of social constructivism and social construction of technology. Those variables and concepts will be taken out of the theories discussed above that have a large potential in explaining the influence the perception and use of GIS can have on the process of agenda-setting, the course, the content and the outcome. These variables will be incorporated in the conceptual framework which will be developed later in chapter 6, and will be tested against the empirical case studies.

4.5 CONCLUSION

When looking at agenda-setting it has been established that in this research only the policy agenda will be looked at and that agenda-setting will be regarded as the process of getting a subject or a problem to gain this attention from government or those closely related to government. Within this definition several theories of agenda-setting have been looked at that provide for a capacity in explaining the influence of the perception and use of GIS on the process of agenda-setting. Firstly the barrier model was discussed (Bachrach & Baratz, 1970). In this model it is assumed that an issue must pass two barriers in order to obtain agenda status, first the barrier of fitting dominant values in society and secondly the barrier of institutional procedures. Secondly the Cobb and Elder model was elaborated on (Cobb & Elder, 1972). Here it is assumed that for an issue to reach agenda-status it must be expanded to a larger public, whether this happens is dependent on the nature of an issue in contrast to the content. A third theory which was discussed was the stream model (Kingdon, 1995). Here the idea of the stage heuristics is dropped and problems and solutions float around until they find each other, together with a positive political climate and the opening of a policy window the issue could reach agenda status. Finally the advocacy coalition framework has been explained (Sabatier & Jenkins-Smith, 1993). Here also the stage heuristic is left behind and it is assumed that several advocacy coalitions negotiate on the content of the issue but also on getting it on the agenda.

Relevant concepts in explaining the influence of the perception and use of GIS in processes of agenda-setting will be taken out of these models and will be incorporated in the conceptual framework of agenda-setting which will be constructed in chapter 6.

Chapter 5

Designing Policy

5.1 INTRODUCTION

In the previous chapter agenda-setting was explained, what it is, what the process entails and how an issue gains agenda entrance. When an issue reaches the agenda, this does not mean any policy change yet, first a policy has to be designed in order for this policy to be implemented. Placing an issue on the agenda only makes sure a problem is discussed, it does not solve the problem and there can be several solutions to the problem. In this chapter it is aimed to answer the second part of the third sub-question: What is agenda-setting and policy design, what do existing theories on both processes entail and how can these existing theories help to research the influence of the perception and use of Geographical Information Systems on these processes? As for agenda-setting now policy design will be dealt with.

This chapter will be about picking an option or alternative to solve the problem which has just been discussed. Which options are available, how to pick such an alternative, how to deal with other actors who prefer another alternative, these are questions that are addressed in the field of policy design. First of all a definition of policy design will be given, in this way it becomes clear what is regarded as policy design in this research. This is important since an understanding of the concept policy design is needed in order to answer the main question. Secondly six theories of policy design will be discussed. Even though there are a large number of theories on the policy design process, as for agenda-setting, only those will be elaborated on that have a potential in researching the influence of the perception and use of GIS on policy design. This is based on existing literature and case studies on GIS and public policy. At the end of this chapter a summary will be given and some conclusions will be drawn.

First it is important to look at what policy design actually is and how the process of policy design proceeds.

5.2 POLICY DESIGN

In the previous chapter agenda-setting was looked at, how to place an issue or problem on the agenda, but then what? The issue has agenda status but that does not change anything in the policy on this certain issue. Even though this issue now holds agenda status this does not mean all relevant actors agree on what the issue actually is and what the solution to this perceived problem should be. How then will the issue or the problem be transformed into policy, how is this policy designed?

There are a large number of definitions of what policy design is (see: Howlett & Ramesh, 1995; Simon et al., 1950; Hill, 1993; March, 1994; Dror, 1968). One of these definitions needs to be chosen in order to grasp what policy design is and what it entails in this research. One of the existing definitions of policy design stands out and incorporates to a large degree what in this research is considered policy design. This definition holds that

> "The proposals may originate in the agenda-setting process itself, as a problem and its solution are placed simultaneously on the government agenda, or they may be developed after the government has agreed to address a problem. […] In all cases, the range of available options needs to be considered and narrowed down to those that policy-makers can accept." (Howlett & Ramesh, 1995. p. 122)

This definition is very elaborate and unambiguous and can be used with all the theories on policy design that will be used in the construction of the conceptual framework.

What this definition implies is that after the agenda is set with an issue, relevant alternatives must be looked at in order to solve the perceived problem. The process of policy design thus becomes the process of defining, considering and accepting or rejecting options for political decision. This implies the process of policy design does not deal with the process of decision-making. A policy proposal is made but the decision of whether to implement this proposal is not. Policy design will in this research be looked according the line of these implications; this does not tell us how this process proceeds. In order to look at the content of this process, different theories of policy design will be looked at.

It must be mentioned before moving on to the different theories of policy design that, as for agenda-setting, the order of these theories is not random. They follow each other chronologically, with each theory being a reaction to past theories. At the start of the study of policy analysis, mostly dated in the 1930s it was believed that actors could act completely rational. The model of policy design which relates to this is the rational actor model which will be discussed below. Very early on several actors reacted to this rationality and claimed this could not be done in practice. The first to react was Simon with his concept of bounded rationality and the idea that the optimal solution to a problem could be found (Simon, 1957). This resulted in the satisficing model. The theories which follow all incorporate to a more or lesser degree the concept of bounds of rationality. The theory of successive limited comparisons challenges Simons idea of the bounds of rationality by claiming the rationality actors can display is even less than Simon assumes. It is also argued that the process of policy-making should not be improved, unlike what Simon claims (Lindblom, 1957). A next response to the rational actor model was provided for by Etzioni, a theory which is called mixed scanning. This theory challenged the rational actor model as well as Lindbloms theory by claiming they were both partially incorrect. The theory aims to provide for a model by which both approaches can be combined, incorporating the strengths of both but leaving out the weaknesses (Etzioni, 1967). The next theory which will be discussed is the normative optimum model, this is, as well as mixed scanning, a reaction to both Lindblom and the rational actor model. The weaknesses of both approaches are acknowledged and a middle ground is attempted to be found. In this theory however this middle ground moves more towards the rational actor model than to Lindbloms theory (Dror, 1968). Finally we will deal with the institutional analysis and development framework. Throughout the 1980s a renewed interest in institutionalism can be found. The institutional analysis and development framework is a result of this renewed interest. Next to the reaction to earlier theories that they lacked an institutional basis, the institutional analysis and development framework also disregards the stage heuristic (Ostrom et al., 1994).

5.3 THEORIES OF POLICY DESIGN

A useful and practical definition of policy design has just been given, now it is important to look at how the process of policy design proceeds. There exist a large number of different theories on the policy design process, but not all of these theories will be discussed. Of these theories only five will be discussed, the satisficing model, (Simon, 1976) successive limited comparisons, (Lindblom, 1959) mixed scanning, (Etzioni, 1967) the normative optimum model, (Dror, 1968) and the institutional analysis and development framework (Ostrom et al., 1994). The choice for these models over any other model of policy design can be justified by looking at the potential they have in explaining the influence of the use and perception of GIS on policy design. The theories chosen do hold this potential, based on existing literature on GIS and public policy. It must be noted that most of the theories that will be discussed are a reaction to another model, the rational actor model. This model does not have the potential to be useful in researching the influence of the perception and use of GIS on policy design but in order to account for a proper understanding of the theories reacting to the rational actor model, this model will first be discussed.

Furthermore it is important to keep in mind the theories which are discussed below entail far more than will be elaborated on. Only those parts of the theory will be discussed that deal with policy design.

5.3.1 The Rational Actor Model

The first theory of policy design that needs to be discussed is the rational actor model. This model does not prove to have influence on the use and perception of GIS in policy design. The rational actor model is more of an ideal type for policy design and less of a theory that can empirically be used. The reason for discussing this theory is because the theories which will be discussed later on, and which do account for an explanatory capacity, are mostly a reaction to this theory. Without an understanding of the rational actor model the other theories would be difficult to grasp.

The core of the rational actor model holds that an actor translates his values and interests into a pay-off or utility function. This means the actor will state his goal, thus the solution to a policy problem, and the way he would like to achieve this goal. All possible alternatives are listed to solve the problem. All these alternatives will closely be looked at and their consequences will be predicted. In terms of costs and benefits the alternatives can be ranked and the actor will then choose that alternative that holds the most benefits and the least costs. This means the rational actor model is very consistent in linking the choice of action to a specific goal (Allison & Zelikow, 1999).

The model is mostly described in a four step manner. The first step deals with the identification of goals and objectives. Secondly the actor lists the complete and exhaustive list of all alternatives possible. A third step is to attach consequences to these alternatives and the final step is the choosing of one of the alternatives. This is fairly easy since the actor only has to look which alternative has the most favorable consequences (Allison & Zelikow, 1999).

Empirical testing of the rational actor model can be found (Allison & Zelikow, 1999) however, in each tested case it is concluded that the rational actor model cannot account for the empirical reality. This can easily be explained by the fact that the rational actor model is an ideal type and not a model to be used to explain public policy-making.

5.3.2 The Satisficing Model

The first model that can have an explaining capacity in researching the influence of the use and perception of GIS, to be discussed is the satisficing model. The model has been developed by Simon and he was one of the first authors to react to the rational actor model (Simon, 1955; 1957). Simon claims that actors cannot be as rational as the rational actor model assumes, they cannot have all the knowledge of all the relevant aspects of their environment. Neither do they have a clear and stable system of preferences nor are they not able to compute all the alternatives. Furthermore consequences can often not be predicted since knowledge of these consequences is fragmentary at best (Simon, 1976). The rationality assumed in the rational actor model therefore, according to Simon, cannot be seen as realistic.

Additionally people are not machines and their behavior is influenced by feelings, hopes and fears (Simon, 1957). This however does not mean that actors do not direct their actions towards a defined goal, actors are still goal-oriented and rational but this rationality has some bounds. This is what is termed 'bounded rationality' and it means that people are limited in their rationality by three factors. Firstly they are limited by unconscious skills, habits and reflexes, secondly by their values and conceptions of purpose and thirdly by the extent of their knowledge and information (Simon, 1976; Lilly, 1992). This is further explained by March:

> "The core notion of limited rationality is that individuals are intendedly rational. Although decision-makers try to be rational, they are constrained by limited cognitive capabilities and incomplete information, and thus their actions may be less than completely rational in spite of their best intentions and efforts." (March, 1994, p. 9)

March then explains the bounds in rationality even more elaborate. Firstly the bounds exist because the human memory is limited, secondly because time and capabilities for attention are limited, thirdly because humans have a limited capability of organizing and summarizing information and finally because humans are limited in the degree of communication and sharing complex information (March, 1994).

Furthermore Simon assumes that the mean-ends relationship in the rational actor model must be challenged. Where the rational actor model assumes a clear distinction between means and ends Simon does not believe this to be the case. Firstly ends are often incompletely or incorrectly stated, secondly a separation between means and ends is often impossible since means are not neutral and thirdly the mean and end terminology is often obscured (Simon, 1976).

Within the idea of bounded rationality and the ideas of the mean-end relationship Simon has developed a theory of policy design, the satisficing model (Simon, 1976). This theory was later further elaborated on by March (March, 1994). The theory claims that optimality is not to be achieved, due to the bounds of rationality. Instead of looking for the best possible alternative actors look for an alternative that is simply 'good enough' (March, 1994). This alternative is then settled for. An alternative is considered optimal if there exists a set of criteria that enables all alternatives to be compared and the alternative is preferred, by these criteria, to all other alternatives. An alternative is considered satisfactory when there is a set of criteria that describes minimally satisfactory alternatives and the alternative in question meets or exceeds these criteria (March & Simon, 1993; Bryon, 1998). What this means is that a set of criteria for a satisficing solution to a problem must be made. Then the actor can start looking for an alternative. In his search still, as in the rational actor model, a cost-benefit analysis must be made. As soon as one alternative is found that meets the criteria this alternative will be chosen and the actor thus does not look any further for more alternatives.

Empirical testing of bounded rationality and satisficing can be found in a large number of contributions. Mostly the concepts of bounded rationality and satisficing are combined with another model of policy-making or decision-making. Simons account of bounded rationality has been one of the contributions to social sciences with the widest impact and

Simon is considered one of the founding fathers of the policy approach. In recent research in case studies bounded rationality is often accepted as given and is used together with other models of policy-making (Parsons, 1995).

5.3.3 Successive Limited Comparisons

A second theory of policy design is the theory of successive limited comparisons, better known as incrementalism. The theory of successive limited comparisons was developed by Lindblom in his 1959 article 'The Science of Muddling Through' (Lindblom, 1959). Like the satisficing model incrementalism is a reaction to the rational actor model as well. Lindblom claims that it is impossible for humans to understand the complexity of social reality and therefore humans cannot process what the rational actor model wishes them to do (Lindblom & Woodhouse, 1993). In Lindblom's words:

> "It [the rational actor model] assumes intellectual capacities and sources of information that men simply do not possess, and it is even more absurd as an approach to policy when the time and money that can be allocated to a policy problem is limited, as is always the case." (Lindblom, 1959. p. 80)

The successive limited comparisons theory is based on five premises. Firstly it is believed the selection of value goals and the analysis of the needed action are closely intertwined. This means that values cannot be selected and clarified in advance. Within politics actors will not agree with each other on this selection of values, an abstract ranking of these values is mostly impossible. What the actor therefore must do is not select any values but choose between policies with their set of values.

Secondly the theory assumes that since means and ends are not distinct, means-end analysis is not possible. This stems from the first premise; since the values are not selected in advance there cannot be an agreed end. This means that the order of first defining the end and then proposing the means is not possible. Means and ends are chosen simultaneously.

Thirdly the test of good policy is not based on meeting certain criteria but when various analysts agree on the policy.

Fourthly analysis is drastically limited; outcomes, alternatives and affected values are neglected. The reason for this is similar to the notion of bounded rationality. Lindblom claims that humans are limited in their intellectual capacities and do not have all available information. Since it is impossible to collect all possible alternatives actors should only look at those alternatives that only differ to a small degree from present policy. The idea behind this is that alternatives that differ fundamentally from present policy are unpredictable in their consequences.

Finally the theory assumes that a succession of comparisons reduces the reliance on theory. The idea behind this is that policy is never made for once and for all, it is constantly made and re-made. Proceeding towards a far goal with a succession of incremental changes, opposed to one drastic change, will avoid lasting mistakes. The reason behind this is fourfold. Firstly because past sequences account for knowledge on probable consequences of similar steps, secondly a radical change would require predictions beyond an actor's knowledge. Thirdly the actor is able to test his previous predictions before moving on to the next step, which avoids risking a large amount of unpredicted consequences. Finally an actor is able to fix a past error since all changes are incremental (Lindblom, 1958; 1959).

What this means in essence is that an actor should not look at values to find agreement but should look at the policy alternative as a whole. Only those alternatives should be looked that differ very little from present policy. In order to reach a long-term goal actors should not look at policy alternatives opting for radical change but rather choose for a series of incremental changes.

Incrementalism, or the approach of successive limited comparisons has been viewed as one of the most influential responses to the rational actor model (Parsons, 1995). A large number of scholars have tested incrementalism against empirical reality and incrementalism is widely used to explain practices in public policy-making. Especially in debates on public reform and spending policy, incrementalism is often used to find an explanation or used to explain why reform has not occurred to the degree initially hoped for. Incrementalism is also criticized as will be demonstrated below (Parsons, 1995).

5.3.4 Mixed Scanning

The theory of mixed scanning was developed by Etzioni in his 1967 article 'Mixed Scanning, a Third Approach to Decision-Making' (Etzioni, 1967). This theory does not only react to the rational actor model but also to the theory of successive limited comparisons. Mixed scanning acknowledges in both theories the weaknesses as well as the strong points and aims to find a middle ground.

The theory of mixed scanning is based on looking at policy alternatives on two levels, a level of scanning and a level of detail. In the first level all possible alternatives are looked at, as in the rational actor model, but acknowledging that time and human capacities are limited, not all these alternatives are looked at in detail. Instead all the alternatives are scanned, looked at generally. Those alternatives that look feasible will move to the second level. It is the actor's discretion to decide on what grounds and on the basis of which criteria the alternatives are scanned and which alternatives can move to the second level.

In the second level the alternatives that were picked are looked at in detail as the rational actor model prescribes. Here all costs and benefits are listed and the best alternative then is chosen. Since the list of alternatives in this level is not so large this becomes possible (Etzioni, 1967; 1968).

When elaborating upon this further we see that an actor should list all relevant alternatives that come to mind when dealing with a policy problem. These alternatives are then examined briefly and those that reveal a serious objection, like unavailable means, normative objections and violations to basic values or interests of other actors of whom support is needed, are rejected. This examination must then be done again with the remaining alternatives but in greater detail, and so further until only one alternative remains (Etzioni, 1967; 1968).

By choosing an alternative in this way the actor would have the advantages of both the theories but not the shortcomings. Each element of the one theory would reduce the shortcomings of the other. The elements of successive limited comparisons reduce the unrealistic aspects of the rational actor model by limiting the level of detail by which the alternatives should be examined. In turn the elements of the rational actor model overcome the conservative slant of successive limited comparisons by making it possible to explore alternatives aimed for the long run (Etzioni, 1967).

What is important within mixed scanning is that Etzioni recognized power as determining variable. The power of the actors involved in designing policy, partially determine whether the proposed alternative will actually become a policy up for decision-making. A proposal backed with enough power is much more likely to be accepted than a proposal backed with less power.

> "Decisions are not made in a vacuum; they are deeply affected by the position and relative power of the decision makers and their relation to one another." (Etzioni, 1986, p. 11)

Knowledge in the theory of mixed scanning is seen as a source of this relative power that can thus back up a proposal. Knowledge is not seen as objective but as a tool used to back these proposals.

As already stated, Etzioni aims to find a middle ground between the rational actor model and incrementalism. Mixed scanning is, together with the normative optimum model which will be discussed below, seen as the most influential response combining full rationality and incrementalism. The model has been repeatedly tested against empirical reality. Even though the model is thought to be very useful the largest critique evolves around whether a fundamental decision is actually fundamental (Parsons, 1995).

5.3.5 The Normative Optimum Model

The next theory to be discussed is the normative optimum model. This model was developed by Dror in his book 'Policy Making Reexamined' (Dror, 1968). Like mixed scanning this model is a reaction to the rational actor model as well as to successive limited comparisons. However, the normative optimum model does not aim to combine the two as mixed scanning aims (Dror, 1964). What the normative optimum model aims to do is that it

> "tries to avoid both extremes, by rejecting pure rationality on the one hand, and by providing an optimal goal that is more than an incrementally improved extrapolation of the present situation on the other hand" (Dror, 1968. p. 131)

The basic characteristics of the model are fivefold. Firstly the normative optimum model should be qualitative instead of quantitative. This means the model deals with qualitative policy-making, all phases of policy-making are discussed regardless of the input or output per phase. Secondly the model should incorporate, next to rational components, extra rational components; these are components like intuition, experience and creativity. These components are needed because of the bounds of rationality. Furthermore in some stages of policy-making only extra rational components will serve the end, for example, creativity is needed to find new alternatives. Finally these components are important since they suit some cases better.

A third characteristic of the model is that the model should incorporate an economic rationale. This means that resources should be allocated to each stage of policy-making so that they will be used most economically.

Fourthly the model should deal with meta policy-making phases. This holds there should be policy-making on policy-making. Here values, problems and resources should be identified together with their allocation.

Finally the normative optimum model should include extensive feedback phases. The rational actor model does not need any feedback since it is perfect in itself. Any other model is not and therefore needs feedback (Dror, 1968; 1975).

When looking at the actual model, this is divided into three stages and eighteen phases, since not all these stages deal with policy design only those which do will be discussed.

The first stage that is discussed is the meta policy-making stage that consists of seven phases. Firstly values are processed and specified to the degree that actions can be pointed out, this phase leans on extra rational components. Secondly reality needs to be processed, it is important that actors match their subjective reality to the objective reality, the degree to which they are able to do so determines the quality of policy-making. The subjective reality of actors determines which problems they perceive and thus the direction they will follow. The third phase deals with processing problems. A problem is the difference between the actor's values and his subjective image of reality. This process relies on extra rational components as well. Fourthly there is a phase of surveying, processing and developing resources. Knowledge is very important in this phase, since this can make sure resources to solve the problem can be identified. The fifth phase deals with the designing and evaluating the policy-making system. This holds that the policy-making system must be divided into sub-units making sure specialization occurs. In the sixth phase problems, values and resources are allocated to the sub-units that have the quality to solve the problems. Finally the last phase deals with determining the policy-making strategy. Here the basic orientations that will be adopted in policy-making situations will be determined (Dror, 1968).

The normative optimum model after the meta policy-making stage proceeds to the second stage, the policy-making stage. Here as well there are seven phases to be distinguished. The first phase deals with sub-allocating the resources which were already allocated. Secondly operational goals must be established, this deals with means rather than ends. The third stage deals with establishing a set of other significant values with some order of priority. Other significant values are those values that do not constitute a direct operational goal. Fourthly a set of major alternative policies must be prepared. The fifth stage accounts for preparing reliable predictions of the significant benefits and costs of the alternatives. The strategy in the first stage must be used here to make choices on which alternatives to look at. Sixthly out of the predicted costs and benefits of the alternative the best alternative must be chosen, this choice is also based on extra rational components. Finally in the last phase the benefits and costs of the best alternative are evaluated and it is decided whether this is sufficient. If the costs are too high or the benefits too low the alternative will be rejected (Dror, 1968).

There is a third stage in the model but this will not be discussed since it does not deal with policy design.

As mixed scanning does, so does the normative optimum model aim to find an alternative combining both the rational actor model and incrementalism. The normative optimum model has been extensively used in several case studies to explain empirical reality but the model also has been tested. Even though the model is deemed very valuable for use in public policy-making, academic as well as in practice the main critique deals with the idea that Dror leaves the public out of the process of public policy-making too often (Parsons, 1995).

5.3.6 The Institutional Analysis and Development Framework

The last framework on policy design to be discussed here is the institutional analysis and development framework. This is developed by Ostrom, Gardner and Walker (Ostrom et al., 1994). The original aim of the framework was not to use it as a framework for policy design but for common-pool resource problems, later it has extensively been used for purposes of researching policy design (see: Rudd, 2004; Imperial, 1999). The framework is not a reaction to any of the models described above but takes institutional features and structure into account. Graphically the framework looks as in figure 5.1.

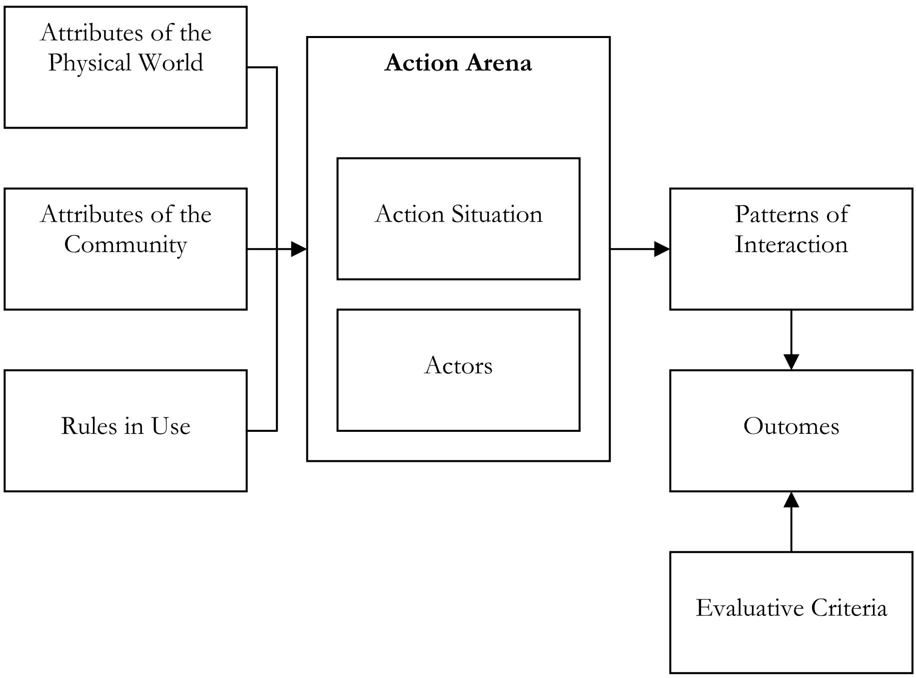

Figure 5.1: The Institutional Analysis and Development Framework (Ostrom et al. 1994. p. 37)

The prime focus of the institutional analysis and development framework is the action arena. This is the social space in which actors interact, exchange goods and service, engage in activities, solve problems and fight regarding a policy problem (Ostrom et al., 1994; Ostrom, 1999).

The action arena consists of an action situation and of actors. The action situation is the situation in which participants must decide among diverse actions, this must be done in the light of the information they possess on the potential outcomes and costs and benefits assigned to these outcomes. Actors are the participants in the action situations who hold preferences, information-processing capabilities, selection criteria and resources (Ostrom et al., 1994).

The actors are linked together through the situation; this means the composition of each action arena is different depending on the policy problem. In the action arena the different actors can negotiate with each other on solving a policy problem. They can push forward ideas and proposals and back these with the resources they have (Ostrom et al., 1994).

The action arena is affected by three factors. Firstly the rules in use, these are formal as well as informal rules which state which actions are prohibited, required and permitted. A second factor is the attributions of the physical world; this determines what is actually possible. This should be viewed in terms of natural or biological possibilities, productability of outcomes and the knowledge of actors. Thirdly the attributes of the community refer to accepted norms of behavior and the distribution of resources among members. This can be referred to as culture (Ostrom et al., 1994).

These three factors determine the scope of actions possible in the action arena and therefore together with actor behavior account for a pattern of interaction that in its turn accounts for an outcome, thus a proposal for policy.

What this means is that

> "participants in a policy network are exposed to a set of incentives that induce them to act in a particular way, but we also assume that their actions are fostered by physical circumstances as well as institutional attributes, rules and norms." (Carlsson, 2000. p. 513)

The IAD framework has been tested empirically on several occasions and is praised for placing institutions back into the mix of public policy-making (Parsons, 1995).

Imperial argues in his case study on ecosystem-based management that the institutional analysis and development framework can really help in explaining empirical reality because of its institutionalism. Furthermore the institutional analysis and development framework allows the researcher to account for rules of behavior and codes of conduct. These are, according to Imperial, crucial to understand the way management and public policy-making proceed in practice (Imperial, 1999).

5.4 COMPARISON AND OVERVIEW OF THE DIFFERENT THEORIES

The six theories discussed above could be compared and contrasted on a large number of points. But as was the case for agenda-setting theories, for this research this is not necessary. The theories will be used to construct the conceptual framework and therefore an exhaustive comparison is not needed. A short comparison on basic points can be very useful, merely for the sake of oversight. The different theories will be compared on the basis of two points, first their core concepts which are essential for the theory and secondly the way they assume the process of policy design proceeds, or should proceed. These points are outlined in table 5.1.

Table 5.1: Overview of the Theories on Two Points

	Core Concepts	Design of Policy
Rational Actor Model	- perfect information - perfect rationality	Proposal is designed by looking at all alternatives, calculating all costs and benefits and choosing the best one.
Satisficing Model	- bounded rationality - satisficing	Actors opt for a satisfactory proposal because of the bounds of rationality
Successive Limited Comparisons	- bounded rationality - conflict of values - incremental decisions	Actors choose a proposal that does not divert far from existing policy
Mixed Scanning	- bounded rationality - conflict of values - power	A proposal is designed by first scanning of all alternatives and second by looking at alternatives that pass the first stage in detail.
Normative Optimum Model	- extra rational components - bounded rationality - conflict of values	Extra rational components are added and a combination between the rational actor model and successive limited comparisons is searched for
Institutional Analysis and Development Framework	- institutions - culture - rules in use - power - conflict of values - policy arena	Proposal is a product of interaction between groups of actors. The interaction is influenced by rules of conduct, culture and institutions

When comparing the theories on their core points the first thing that stands out is that almost all of the theories deal with the degree of rationality. Only the institutional analysis and development framework does not. This can be explained by the fact that this framework does not deal with individual actors but with a broader perspective. All the other models do deal with the degree of rationality, only the rational actor model assumes perfect rationality while all the other models assume bounds in this rationality. The normative optimum model, additionally, adds extra rational components, like creativity and intuition, to the equation.

A second point that can be noticed is that only the satisficing model deals with sub-optimality. The other models either do not mention optimality or do not in advance establish that sub-optimality could be a possible outcome. What is dealt with in most models is the idea of what is acceptable, the rational actor model only accepts a perfect outcome, the satisficing model accepts a satisficing outcome and successive limited comparisons settles for an outcome on which various analysts agree upon. Mixed scanning implicitly accepts the outcome that remains after rejecting all other outcomes and the normative optimal model states that an outcome has to be good, but does not define this. The institutional analysis and development framework does not mention acceptability in outcomes, here the outcome is the result of interaction and whether this is acceptable or not, it is simply given.

Thirdly conflict of values are important, they are to be found in successive limited comparisons, mixed scanning, the normative optimum model and the institutional analysis and development framework. It must be mentioned that values in each model are treated differently. In successive limited comparisons and the normative optimum model it is assumed that values can conflict with one another, making the designing of policy difficult. In mixed scanning and the institutional analysis and development framework values are seen as belonging to actors. The actors holding these values come into conflict with one another on the basis of these values. The rational actor model does not deal with conflicts of values since it believes a perfect outcome can be found. The satisficing model does not mention values very explicitly.

A fourth interesting point of comparison is power. This comes forward only in mixed scanning and the institutional analysis and development framework. This is linked to the way both look at values. When actors hold certain values that come into conflict with values held by other actors, power is what determines which actor will win and see most of their values back in the final proposal. Therefore, a proposal backed with enough power is more likely to become the final proposal than a proposal backed with little power.

Finally the institutional analysis and development framework stands alone in taking structure into account. The other theories do not, this can be explained by the fact that they deal with individual actors and the institutional analysis and development framework deals with a much broader perspective. In terms of structure the institutional analysis and development framework take institutions, culture, the physical world and rules of conduct into account.

Summarizing the core of the model it can be stated the rational actor model assumes a perfect outcome can be reached by making a list of all alternatives and attaching costs and benefits to them, the best alternative will be chosen. The satisficing model assumes this is not possible and there are bounds in rationality, since this is the case actors should opt for a solution that is satisficing. Successive limited comparisons also take the bounds of rationality into account and assume that actors should choose an alternative that does not differ far from present policies. Mixed scanning tries to find a middle ground between the rational actor model and limited successive comparisons and claims that actors should first scan all possible alternatives and look to those alternatives in detail, that seem feasible in the scan. The normative optimum model tries to combine the rational actor model and successive limited comparisons as well, and adds extra rational components. Finally the institutional analysis and development framework assumes an alternative is found by interaction of groups of actors, either helped or constrained by structure.

In chapter 6 these concepts will be used to construct a conceptual framework according the lines of social constructivism and social construction of technology. As for agenda-setting, here within policy design those variables that prove to have a large potential in explaining the influence of the perception and use of GIS in policy design, will be used in the conceptual framework which will be developed in chapter 6.

5.5 CONCLUSION

At the end of this chapter it has been established that in this research policy design is seen as the process of designing, considering, rejecting and accepting options or alternatives for a policy problem and to formulate them into a policy proposal on which later on can be decided. The decision-making process will thus not be discussed.

Taken this definition into account, several theories of policy design have been looked at in order to find concepts and variables that can help researching the influence the use and perception of GIS can have on policy design. Most of these theories were reactions to the rational actor model which assumes that humans are able to list all the possible alternatives, calculate all the consequences of these alternatives and in the end pick the alternative which is most favorable. The first theory discussed is the satisficing model; here it is believed that humans cannot display the degree of rationality assumed by the rational actor model. Humans are bound in the degree of rationality they can display and therefore, together with the fact that time and resources are often lacking, actors opt for a sub-optimal solution that fits the criteria of being satisfactory (Simon, 1956; 1976; March, 1994). A second theory that was elaborated on was successive limited comparisons, here as well it is assumed that humans are limited in the degree of rationality they can display. Furthermore it is believed that actors should choose those alternatives that do not differ severely from the present situation, making sure they do not opt for radical change which can have unforeseen consequences (Lindblom, 1957). Thirdly mixed scanning was explained, this is a mix between the rational actor model and successive limited comparisons. It prescribes to first scan all possible alternatives very generally and then look in detail at the alternatives which look viable in the scan (Etzioni, 1967). The normative optimum model is also a reaction to the rational actor model and successive limited comparisons, in this model the bounds of rationality are acknowledged but extra rational components are added (Dror, 1968). Finally the institutional analysis and development framework was looked at. In this framework actors negotiate on a proposal in the action arena and their actions are constrained or enhanced by culture, rules in use and attributes of the physical world (Ostrom et al., 1994).

It can be concluded that within these theories there are several core concepts and variables that could be very useful in researching the influence of the use and perception of GIS on policy design. These core concepts will be taken out of these models and will be used when constructing the conceptual framework of policy design in chapter 6.

Chapter 6

Towards a Conceptual Framework

6.1 INTRODUCTION

In the previous chapters the technology debate has been discussed and the position for social construction of technology has been chosen. Different theories of agenda-setting and policy design have been explained.

All these positions and theories now have to come together and become the building blocks of a conceptual framework which can be used to analyze case studies. This conceptual framework can be seen as a tool to research the influence of the perception and use GIS in empirical reality. Additionally this framework can be viewed as a pattern of expectations which can be tested against empirical reality as will be done in the case studies. The aim of this research is to answer the fourth sub-question: In which way is it to be expected that processes of agenda-setting and policy design proceed when dealing with Geographical Information Systems?

In this research there will be two conceptual frameworks, one for agenda-setting and one for policy design.

Firstly it is important how to look at our social reality, social construction of technology has been chosen in the technology debate but now a broader epistemological position is needed in order to look at the expected relations between variables in the conceptual frameworks. This position, social constructivism, will first be explained and later used to look at reality.

Secondly the concepts that will be taken out of the theories of agenda-setting and social construction of technology will be explained and conceptualized. After this is done the conceptual framework will be presented and explained. The same will be done for policy design.

Later on in this chapter it will be explained what the research methods and techniques are that will be used to research the empirical reality. A justification for a multiple case study will be given and the criteria for case selection will be elaborated on. At the end of the chapter some conclusions will be drawn and a short summary will be given.

6.2 SOCIAL CONSTRUCTIVISM AS A LENS

As mentioned, social construction of technology is the chosen position in the technology debate. The choice for social construction of technology as dominant approach in this research does not stand alone. A general view on reality must be adopted in order to come to an answer to the main question of this research but also to account for a coherent way of getting there. Social construction of technology as a way to view the relation between technology, humans and society is part of a larger epistemological position, namely social constructivism (Berger & Luckmann, 1966; Searle, 1995; Burr, 1995; Weick, 1969; 2001;

Gilbert, 1992). Social constructivism will be used as a lens to look at reality but also to construct the conceptual frameworks.

The data obtained and the analysis of this data will be done by using a social constructivist viewpoint. The reason for this can be found in the same way as the justification for social construction of technology as dominant approach in this research. Firstly the main question with its emphasis on perception and use of GIS as influential factors demands for an epistemological position in which perception and sense making are key points. This cannot be researched by a purely positivistic viewpoint. Secondly existing empirical data in the field of GIS and public policy suggest that a social constructivist viewpoint would do justice to the complexity of processes of agenda-setting and policy design since a large number of actors are involved with different political values.

6.2.1 The Core of Social Constructivism

The core of social constructivism has already been described in the section on social construction of technology. Social constructivism evolves around attributing agency to humans. Their actions and thoughts shape society and the outcomes of any action are never inevitable or fixed. This also means that every meaning attributed to any object is never right or wrong, but context driven and shaped by humans. Humans therefore collectively produce their social environment and give meaning to objects around them and constitute their social and institutional rules, whether conscious or unconscious (Berger & Luckmann, 1966; Collin, 1997; Weick, 2001).

What is often difficult when looking from a social constructivist viewpoint is deciding what is real, when everything is shaped, what is reality then? A distinction can be made between 'brute facts' and 'institutional facts' Brute facts are those facts that exist regardless of human existence, for example water or mountains. Institutional facts are those facts that require human institutions for their existence. These institutions can be legal, formal or informal and social. Examples of institutional facts are money, the media and education. An institution is a product of its history and would be impossible to understand without the process of shaping by which it was constituted (Searle, 1995; Berger & Luckmann, 1966).

As explained in the approach of social construction of technology after an object has been shaped and has been given meaning, a dominant meaning prevails. The object or institution then will influence society according to the lines of the meaning it has been given (Bijker, 1995; Searle 1995; Berger & Luckmann, 1966; Weick, 2001; Giddens, 1984; 1987; 1995).

> "we do not experience things as material objects, much less as collections of molecules. Rather, we experience a world of chairs and tables, houses and cars, lecture halls, pictures, streets, gardens, houses and so forth." (Searle, 1995)

> "Institutions also, by the very fact of their existence, control human conduct by setting up predefined patterns of conduct, which channel it in one direction as against the many other directions that would theoretically be possible." (Berger & Luckmann, 1966 p. 55.)

The institutions are shaped by humans and after this process they influence behaviour according the lines of the meaning they have been given. Therefore the perception humans hold on objects is the dependent variable. The features of these objects and institutions can be divided into intrinsic features of the object, these are those features that would exist without human institutions, and observer-relative features, these are the features that are given to the object by humans (Searle, 1995). For example: the intrinsic features of a screwdriver are that it has a certain mass and a certain chemical composition, the observer-relative feature is that it is a screwdriver and not just an object with a certain mass and composition, because people use it as a screwdriver. This is comparable to what Bijker terms the making of the artefact, an object is there already and humans give it meaning, shape its consequences and decide on its morality.

Social reality within the viewpoint of social constructivism becomes the subject of three core ideas. Firstly the assignment of function, this is always observer-relative. The assignment of function deals with simply the function the object holds. For example, money has the function of exchanging it for goods. Secondly social reality deals with collective intentionality. This is comparable with closure on the meaning of technology. A group of people agree on the meaning, values and morality of a technology (Bijker, 1995). Within the larger framework of social constructivism this means that a very large amount of people together have reached consensus on the meaning of objects. One can thus state that there is some sort of collective 'I believe that you believe that I believe..' is going on. Mostly this is culture dependent and may thus vary between groups of people (Searle, 1995).

> "Men *together* produce a human environment, with the totality of its socio-cultural and psychological formations. None of these formations may be understood as products of man's biological constitution, which […] provides only the outer limits for human productive activity. Just as it is impossible for man to develop as man in isolation, so it is impossible for man in isolation to produce a human environment." (Berger & Luckmann, 1966)

Thirdly a core idea within social constructivism is constitutive rules. These rules are the rules needed to create the possibility of a certain action, without these rules the action could not be conducted. For example the rules of the game chess. Without these rules, one could not play chess, one could play with the pieces, but one would not be playing chess. It than becomes clear that institutional facts can only exist within the system and framework of these constitutive rules (Searle, 1995). These constitutive rules always come in the form:

X counts as *Y* in context *C*
Dollars count as *Currency* in *the USA*
Black counts as *the Color of Mourning* in *Europe*
Pyjamas count as *inappropriate* in *business meetings*

The X could be anything, from an object to a phenomenon, just a Y, which could be a value or norm or something objective. The C could be a physical place but also any other context. The X is always created by humans and what ever X stands for, it is always shaped (Hacking, 1999).

> "X was brought into existence or shaped by social events, forces, history, all of which could well have been different." (Hacking 1999. p. 6.)

An institution thus permits the creation of institutional facts either because firstly the institutional structure guarantees them, for example: a voting ballot put in a box at election time counts as an opinion of whom should rule a country. Secondly because the use of explicit performative utterances, which means that a performance itself is an institutional fact. For example, when one declares parliament in session, the institutional fact that parliament is in session is created.

Continued existence of institutional facts is guaranteed as long as people collectively recognize and accept the existence of the fact in question. The status of the fact is constituted by its collective intentionality and can thus only be removed by this collective intentionality. For example, if the inhabitants of a territory collectively refuse to acknowledge property rights, in whatever situation, these property rights cease to exist. The same goes for national identity.

Institutional facts only exist by human agreement and mostly they need official representation to be recognized. A bill says '10 Euros'. So we all know the value of the bill; a passport indicates the status of the bearer in a specific country (Searle, 1995; Kukla, 2000).

> "social reality is somehow generated by the way we think or talk about it, by our consensus about its nature, by the way we explain it to each other, and by the concepts we use to grasp it." (Collin, 1997 p. 2.)

Summarizing this briefly it can be stated that humans create their social reality by institutions, which permit to create institutional facts, which are, in their turn, not objective reality but merely agreements between people or within groups of people. These institutional facts, once established, will influence society.

6.3 A CONCEPTUAL FRAMEWORK OF AGENDA-SETTING

In this section the conceptual framework of agenda-setting will be built and explained. As mentioned this is the place where social constructivism, social construction of technology and theories of agenda-setting must come together into a framework which can be used to analyze case studies later on. In order to come to this conceptual framework first the building blocks taken from existing models of agenda-setting but also from social construction of technology and social constructivism, will be briefly listed and operationalized, after this the model can be constructed.

6.3.1 Conceptualization of Agenda-Setting

After explaining the different theories it is time to place GIS in the equation. Those variables and concepts will be taken out of the theories discussed above that have a large potential in explaining the influence the perception and use of GIS can have on the process of agenda-setting, the course, the content and the outcome. Each core concept will be elaborated on below.

Policy Sub-Systems and Advocacy Coalitions

Policy sub-systems and advocacy coalitions stem from the advocacy coalition framework (Sabatier, 1993) here the policy sub-system deals with the entire interaction on a certain issue the advocacy coalition works within the sub-system and refers to a group with the same basic values and beliefs who is willing to act upon an issue.

When researching the influence of the perception and use of GIS it will be assumed that there exist several different groups, or advocacy coalitions which try to place their issue on the agenda. These coalitions need to be identified as well as their relationship with each other and the issue they are trying to obtain agenda status for.

Technological Frame

The technological frame is the interpretive scheme actors have to give meaning to their social reality. The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors, this shapes the technology. Each coalition in the policy sub-system thus has a different technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995; Berger and Luckmann, 1966; Weick, 2001; Searle, 1995).

The influence of the perception and use of GIS on agenda-setting can only be understood when the technological frames of actors are identified. This determines how they perceive GIS and therefore will partly determine their actions and their preferences.

Mobilization of Bias

Within their technological frame the actors in the policy sub-system will try to mobilize in order to place their issue on the agenda. This deals with mobilization of bias. The idea of mobilization of bias is that dominant values and procedures operate in the favor of some and the disadvantage of others. This way some issues are organized out of politics while some issues gain agenda status, since some issues conflict with dominant values and others do not (Bachrach & Baratz, 1970; Cobb & Elder 1972).

This is important in researching the influence of the perception and use of GIS on agenda-setting. It becomes clear here, taking social constructivist theory into account, that these dominant values are accepted by society as a whole, this still means that certain coalitions or ideas might be favored over other groups or ideas (Bachrach & Baratz, 1970; Douglas & Wildavsky 1982). It is therefore significant to look at which coalitions and ideas are favored by these values in order to understand how this determines the chances for agenda status for a certain issue.

Power

It is assumed then that power is a key concept within researching the influence of the perception and use of GIS on agenda-setting. The ability of a coalition to place their issue on the agenda is not only dependent on being favored by dominant values but also by power. The amount of relative power a coalition holds is partially determining for whether the issue will reach agenda status (Bachrach & Baratz, 1970; Sabatier, 1993; Dahl, 1961).

Power must be seen as embedded in institution. Humans have agreed upon the idea that a group with a certain amount of money has more power than another group, or that a group with a certain status is more legitimate than another group and thus will have more power. For this reason it is important to look at the perceived amount of power a certain coalition holds and how this might have been altered by the use of GIS, but also how other coalitions perceive the amount of power this coalition holds.

Conflict of Values

When the different coalitions all try to obtain agenda-status for their issue or their perceived problem, with the definition they attached to this, other coalitions will try to block this issue from the agenda, as comes forward in mobilization of bias. This deals with conflict of values, each coalition holds its own set of values and within these values they will frame their issue up for agenda status (Bachrach & Baratz, 1970; Kingdon, 1995; Sabatier, 1993).

The different coalitions on the basis of the values they hold can come into conflict, while the one coalition might stress one value this value might not be stressed by another coalition or might even be seen as invalid, incorrect or illegitimate.

For researching the influence of the perception and use of GIS it is thus important to establish which coalition holds which set of values and with which other coalition these values might come into conflict. This conflict establishes the dynamic of the agenda-setting process and can give insight in the course of the process itself.

Formal Institutional Features

Formal institutional features are taken into the conceptual framework as well; they can be either an enhancing factor or a constraining factor, dependent on the coalition. Formal institutions and their procedures might make sure that an issue cannot be addressed. On the other hand, these formal institutions can also form an opportunity for certain issues (Bachrach & Baratz, 1970; Sabatier, 1993).

It must be noted here, taking social constructivist theory into account that formal institutions are not given but are also shaped by humans; we invented these formal institutions, their procedures and their rules. They do not exist outside of the world of agenda setting but they are part of our social reality. It thus is very possible that a formal institution favors one issue over another, as explained in the mobilization of bias.

In researching the influence of the perception and use of GIS on agenda-setting the relevant institutional features must be identified and their influence on the policy sub-system must be analyzed. It must be looked at how they constrain or enhance the action possible by the different coalitions. Furthermore since they are man-made, it is also important to see whether they can be altered by the use of GIS.

Nature of the Issue

The nature of the issue might influence the way coalitions act as well. This determines whether an issue will reach agenda status since the expansion of the issue is dependent on this nature (Cobb & Elder, 1972).

It must be noted that at first glance the nature of the issue seems to be inherent to the issue. This is not the case. An issue is always made up out of institutions and institutional facts; an issue is never just about an natural occurrence. When the issue is about a natural occurrence it is always about the value, consequence or function of this natural occurrence, which thus makes it shaped by humans. The institutions and institutional facts or the assignment of function is determinant of the nature of the issue; this determines whether the issue is concrete, abstract, peculiar, enduring, complex or extra ordinary.

Since the nature of the issue is so determining on whether an issue will reach agenda status it is important to look at the nature of the issue and to establish how coalitions perceive this nature.

Policy Window

Finally the policy window is one of the concepts to build the conceptual framework. The policy window provides for an opportunity for advocates of a proposal to push their idea forward (Kingdon, 1995). The policy window mostly occurs by a change in the political or problem stream. This means that the national mood changes, or the administration changes.

In researching the influence of the perception and use of GIS on agenda-setting the policy window is very important. It is important to see whether a policy window opens so that coalitions can push their idea forward, since this is a determinant for agenda status. Furthermore it must be looked at whether the perception and use of GIS itself could account for the opening of a policy window.

After these concepts have been listed they can come together as building blocks into the conceptual model of agenda-setting.

6.3.2 The Conceptual Framework of Agenda-Setting

The conceptual framework of agenda setting consists of three parts and their interplay with each other. Firstly the policy sub-system in which interactions between groups of actors, advocacy coalitions occur. Secondly of all the characteristics of technology, this refers to the technology itself, in this case GIS. And thirdly the structure, which refers to the structures in society as a whole.

The policy subsystem is taken from the advocacy coalition framework (Sabatier, 1993). This is the social space in which individuals interact with one another regarding the issue at stake. The composition of actors and groups of actors in the action arena thus differs per policy problem.

All the actors in the action arena have their own technological frame (Orlikowski, 1990; 1992; Orlikowski and Gash, 1994; Bijker, 1995). The technological frame is the interpretive scheme actors have to give meaning to their social reality (Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors, this shapes the technology (Orlikowski and Gash, 1994, Bijker, 1995). Each coalition in the policy sub-system thus has a different technological frame.

As stated, within the policy sub-system several advocacy coalitions participate. They all have their own issue and would like to come to agenda status for that issue that fits their values and norms. Within the policy sub-system these groups might come into conflict with one another, trying to push their values and norms forward within the issue at stake in order to find agenda status for an issue of their appreciation. It is very conceivable that this conflict will occur since different groups hold different values (Bachrach & Baratz, 1970; Kingdon, 1995).

This is where power comes in. The group with a large deal of power is far more likely to see a large deal of their values and beliefs back into the issue reaching agenda status, a coalition with less power will also see less of their beliefs back in the issue. Within the policy subsystem there are also groups that will try to hinder certain issues and alternatives from reaching agenda status (Bachrach & Baratz, 1970; Cobb & Elder, 1972). Depending on their relative amount of power they will be successful, fail or achieve a certain degree of success (Bachrach & Baratz, 1970; Cobb & Elder, 1972).

These actors in the action arena then will have to come to a consensus, with either all the groups involved or only a part of the groups, depending on relative power. The values of groups with a large amount of power are very likely to be seen back in the final issue to reach agenda status (Bachrach & Baratz, 1970; Cobb & Elder, 1972).

The structural factors within society as a whole can be divided into three separate fields, firstly the formal institutions, (Bachrach & Baratz, 1970; Sabatier, 1993) secondly the nature of the issue, (Cobb & Elder, 1972) thirdly the policy window (Kingdon, 1994; Cobb & Elder, 1972).

The formal institutions are the formal rules and laws that account for the legal system relevant to the policy sub-system. The actions taken in the policy sub-system, the issue trying to reach agenda status, need to fit in the legal system in use. An alternative that is illegitimate, constitutionally incorrect or otherwise not a match with the legal system will thus be disregarded. The formal institutions thus determine the scope of the actions and interactions possible within the policy sub-system.

Secondly the nature of the issue is important, the nature of the issue determines whether expansion to a larger public is possible and to which degree. A complex issue is less likely to expand to the general public than a fairly simple issue which a large group of people can understand. When the nature of the issue hinders expansion of the issue the advocacy coalition pushing this issue forward clearly loses power while they are not able to mobilize people for their cause. The nature of the issue therefore influences the interactions possible in the policy sub-system as well as the relative amount of power coalitions possess.

Thirdly the policy window comes in. The policy window is the opportunity to push an issue forward. When the policy window is not there at the time actors would like to push the issue forward the issue has fewer chance of gaining agenda status, while the national mood and the public is not ready for this issue. The opening of a policy window therefore influences the scope of interactions possible in the policy sub-system.

The interplay between technology, structure and the policy sub-system in order to come to agenda status moves through four channels. It must be noted that these channels are not in any form of chronological order.

First of all the influence of the structure on the policy sub-system. As described above the formal institutions, the nature of an issue, the policy window and the dominant values determine the scope of interaction possible in the policy sub-system. In this way the policy sub-system is influenced by the structure.

Secondly the policy sub-system influences technology, through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artefact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995; Orlikowski, 1992).

Thirdly technology influences the policy sub-system, this because of the technological frame, although actors have shaped the technology and made it what it is, now technology within the meaning it has been given facilitates and constraints human action in the policy sub-system (Orlikowski, 1992).

Finally technology influences structure, this corresponds with the structuration theory, (Giddens, 1984) this through the actions in the policy sub-system. After the actors in the policy sub-system have shaped technology and closure occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure, new rules and laws might be made and it will be embedded in the culture. So the structure is a result of previous actions (Orlikowski, 1992). Graphically the conceptual framework can be displayed as in figure 6.1.

Summarizing this means that there is a policy sub-system, in which interaction is influenced by formal institutions, the nature of the issue and the policy window. The policy sub-system is also influenced by technology which, after it is shaped by the actors, constraints and facilitates the actions in the policy sub-system through the technological frames the different groups of actors have. Once established, the technology will influence the structure. In the policy sub-system several groups try to push their values, which could conflict with values held by other groups, forward in order to come towards a situation in which their preferred issue reaches agenda status. They do so within their technological frame and with their relative power. Finally agreement will be reached and one alternative will be chosen as the alternative that will constitute for the issue which reached agenda status.

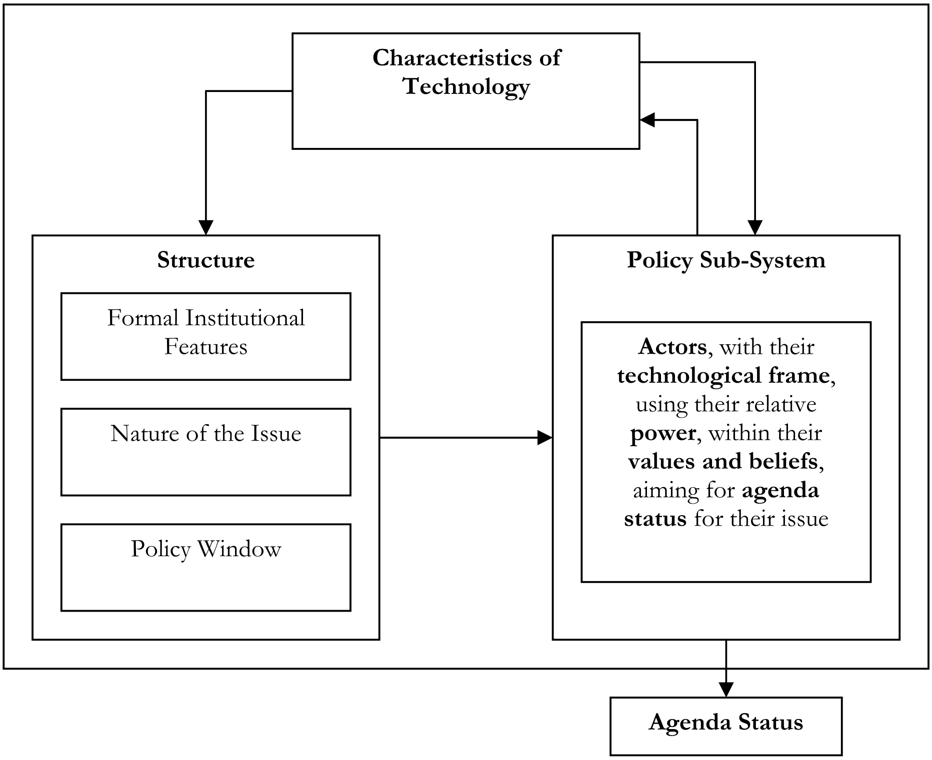

Figure 6.1: Conceptual Framework of Agenda-Setting

6.4 A CONCEPTUAL FRAMEWORK OF POLICY DESIGN

After constructing the conceptual framework of agenda-setting the conceptual framework of policy design can be made. This conceptual framework will be very similar to the conceptual framework of agenda-setting since the same underlying epistemological assumptions are made and since both lean on social construction of technology. In order to come to this conceptual framework first the building blocks taken from existing models of policy design but also from social construction of technology and social constructivism, will be briefly listed and operationalized, after this the model can be constructed.

6.4.1 Conceptualization of Policy Design

Before coming to the explaining of the model itself first its core concepts will be explained. GIS now needs to be addressed. As for agenda-setting, here within policy design those variables that prove to have a large potential in explaining the influence of the perception and use of GIS in policy design, will be used in the conceptual framework. Below these concepts will be addressed.

Action Arena

What for agenda-setting the policy sub-system means, is for policy design the action arena. This is the social space in which actors or groups of actors interact and aim to push their values and ideas forward into a policy proposal (Ostrom et al., 1994). The reason for the difference in terminology stems from the fact that in the conceptual framework of policy design, theories of policy design are relied on. Therefore their terminology is used as well.

When researching the influence of the perception and use of GIS it will be assumed that there exist several different groups in the action arena which try to push their values forward towards a policy design. These groups need to be identified as well as their relationship with each other and the issue they are trying to obtain agenda status for.

Technological Frame

With the technological frame the same concept is addressed as was for the conceptual framework of agenda-setting. The technological frame is the interpretive scheme actors have to give meaning to their social reality. The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors, this shapes the technology. Each group of actors in the action arena thus has a different technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995; Berger and Luckmann, 1966Weick, 2001; Searle, 1995).

The influence of the perception and use of GIS on policy design can only be understood when the technological frames of actors are clear. This determines how they perceive GIS and therefore will partly determine their actions and their preferences.

Bounded Rationality

The concept of bounded rationality must be incorporated into the conceptual framework as well. The concept holds that the human mind is not able to account for a full degree of rationality. We cannot account for all possible alternatives, predict all possible consequences and refer to all possible costs and benefits (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968).

When researching the influence of the use and perception of GIS on policy design it is important to keep this in mind. The actors in the action arena are not able to list all alternatives and all consequences. It is important to look at which alternatives they do list and which consequences they attribute to them. Also it is very important to see how they view GIS in helping them to list consequences. The use of GIS could change the way they attribute consequences to alternatives through the assigned functions of GIS.

Satisficing

Satisficing must be taken into the conceptual framework as well, satisficing holds that when designing policy actors do not aim for an optimal solution but settle for a solution that is satisfactory (March, 1994).

Here it is important to look at what the criteria for each actor in the action arena are for an alternative to be satisfactory, these criteria might differ for each group of actors. The way policy is designed is partly dependent on the convergence of these criteria among the different groups. Furthermore GIS must be looked at, does the use and perception of GIS alter these criteria, either because there are more possibilities or because the application is new and there are so many potential risks.

Power

Power must also be taken into the conceptual framework; this will be done in exactly the same way as for the conceptual framework of agenda-setting. Power thus deals with the ability of a group of actors to translate their ideas into the final policy design. The amount of relative power a group of actors holds is determining for how much of its ideas will be seen back in the final policy design (Etzioni, 1967; Dahl, 1961).

As for agenda-setting it is important to look at the perceived amount of power a certain group holds and how this might have been altered by the use of GIS, but also how other groups perceive the amount of power this group holds.

Conflict of Values

Conflict of values will be treated the same way as in the conceptual framework of agenda-setting as well. Each group of actors holds its own set of values and within these values they will frame their policy alternative (Etzioni, 1967). The different groups on the basis of the values they hold can come into conflict, while the one group of actors might stress one value this value might not be stressed by another group or might even be seen as invalid, incorrect or illegitimate.

For researching the influence of the perception and use of GIS it is thus important to establish which groups adopted which values and which conflicts occur. These conflicts establish the dynamic of the policy design process and can give insight in the course of the process but also in the content. The group with the most power is most likely to win any conflict and place their values in the final policy proposal.

Formal Institutional Features

Formal institutional features are taken into the conceptual framework as well; they can be either an enhancing factor or a constraining factor, dependent on the group of actors in question. Formal institutions and their procedures might make sure that some alternatives cannot be considered but may also favor some groups over others (Ostrom et al., 1994).

In researching the influence of the perception and use of GIS on policy design the relevant institutional features must be identified and their influence on the actions in the action arena must be analyzed. It must be looked at how they constrain or enhance the action possible by the different groups. Furthermore since they are man-made, it is also important to see whether they can be altered by the use of GIS.

Rules in Use

Like the formal institutional features the rules in use also determine the scope of actions in the action arena. They are the informal rules not legally laid down (Ostrom et al., 1994; Stone, 1997).

In researching the influence of the perception and use of GIS it is very helpful to identify these rules in use and establish what their influence in the action arena actually is. Which groups do they constrain and which groups do they help. It is also significant to see which policy alternatives they leave as unfeasible all together. Furthermore it must be analyzed whether the use of GIS can alter these rules in use, and if so how.

Culture

Finally culture will be incorporated into the conceptual framework of policy design. Like the formal institutional features and the rules in use, culture influences the actions possible in the action arena. Culture can account for which alternatives are looked at but also at dominant values in society which policy proposals need to meet (Ostrom et al, 1994).

The relevant cultural aspects need to be identified and the dominant values need to be documented. In this way it becomes possible, when researching the influence of the perception and use of GIS on policy design, to see how culture constraints or enhances actions in the action arena. Also here it must be looked at whether the use of GIS can influence culture.

After these concepts now have been listed they can come together as building blocks into the conceptual model of policy design.

6.4.2 The Conceptual Framework of Policy Design

The conceptual framework of policy design leans on the same structure as the model of agenda-setting, only minor differences in the core concepts can be found.

Like the conceptual framework of agenda-setting the conceptual framework of policy design consists of three parts and their interplay with each other. Firstly the action arena in which interactions between actors and groups of actors occur. Secondly technology, this refers to the technology itself, in this case GIS. And third the structure, which refers to the structures in society.

The action arena is taken from the institutional analysis and development framework (Ostrom et al. 1994), this is the social space in which individuals interact with one another regarding the policy problem at stake. The composition of actors and groups of actors in the action arena thus differs per policy problem. This is thus comparable with the policy sub-system.

As for agenda-setting here as well all the actors in the action arena have their own technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995; Berger and Luckmann, 1966 Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors, this shapes the technology (Orlikowski and Gash, 1994, Bijker, 1995). Each group of actors in the action arena thus has a different technological frame.

All actors in the action arena have their own agenda and would like to come to a design of policy that fits their values and norms. Within the action arena these groups might come into conflict with one another, trying to push their values and norms forward within the policy design in order to find a solution to a problem. It is very conceivable that this conflict will occur since different groups hold different values (Lindblom, 1959; Etzioni, 1967; Dror, 1968).

The group with a large deal of power is far more likely to see a large deal of his values and beliefs back into the proposal, a coalition with less power will also see less of his beliefs back in the proposal.

These actors in the action arena then will have to come to a consensus, with either all the groups involved or only a part of the groups, depending on relative power. The values of groups with a large amount of power are very likely to be seen back in the final policy design. But this does not design the policy yet. There are two additional things that must be mentioned before a final policy is designed and agreement of one or more groups on the design is found (Etzioni, 1967).

First the idea of bounded rationality, taken from Simon (Simon, 1955; 1957; 1976), the actors in these groups cannot account for all possible consequences, cost and alternatives, they are limited in the degree in which they can act rationally, it is therefore in this conceptual model not the case that actors will list all possible alternatives, consequences costs and benefits and pick that alternative that fits their values best. Simply because they are not able to do so.

That brings us to the second concept, namely satisficing, taken from the satisficing model (March, 1994). Optimality is hard to achieve, especially when resources and time are lacking. Additionally agreement on what is optimal is hard to be found especially when dealing with agreement between different groups. Therefore in the conceptual framework of policy design the groups will not aim for an optimal solution, they will aim for a satisfying solution, one they can live with. As soon as this solution is reached they will stop searching for a possible better solution since they have found a solution that is good enough. Groups with a large amount of power will thus go for an alternative that fits their values for a large deal, groups with less power will count their losses and settle for something since they know this is the best they can get, arguing further will not bring them towards an alternative that fits their values better.

The structure of society as a whole can be divided into three separate fields, firstly the formal institutions, secondly the rules in use and finally the culture. This corresponds with the institutional analysis and development framework (Ostrom et al. 1994).

The formal institutions are the formal rules and laws that account for the legal system relevant to the action arena. The actions taken in the action arena, proposals for the policy design of the coming up with alternatives, need to fit in the legal system in use. The formal institutions thus determine the scope of the actions in interactions possible within the action arena.

Secondly the rules in use are important. The rules in use are different from the rules made by the institutions because the rules in use are not formalized, they refer to informal rules. This could entail a number of things, first how the interaction within groups occurs, if this is not laid down in a formal matter there mostly is a code of conduct, certain people function as leaders others as followers. Second these rules also entail the interaction between groups, if it is normal to invite interest groups in negotiations this will be done a next time as well, the way groups approach each other is mostly established within informal rules. These informal rules influence the actions and interactions within the action arena and in this way determine these actions.

Thirdly culture comes in. The actions in the action arena are influenced by the leading culture, the leading values and norms. Alternatives that are seen as despicable in a certain culture, illegitimate, or unwanted will be filtered out. The culture of a community thus determines the scope of the actions in the action arena and also the interactions within the action arena.

The interplay between technology, structure and the action arena in order to come to a policy proposal moves through the same four channels as in the conceptual framework of agenda-setting. First of all the influence of the structure on the action arena. As described above the formal institutions, the rules in use and the culture determine the scope of interaction possible in the action arena. In this way the action arena is influenced by the structure.

Secondly the action arena influences technology, through the shaping of technology, technology becomes the product of human action and the artefact it is (Bijker, 1995, Orlikowski, 1992).

Thirdly technology influences the action arena, this because of the technological frame, although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992).

Finally technology influences structure, corresponding with the structuration theory, (Giddens, 1984) this through the actions in the action arena. After the actors in the action arena have shaped technology and closure on the meaning of technology occurs the established technology will influence the structure, new rules and laws might be made and it will be embedded in the culture. So the structure is a result of previous actions (Orlikowski, 1992).

Graphically the conceptual framework of policy design can be displayed as in figure 6.2.

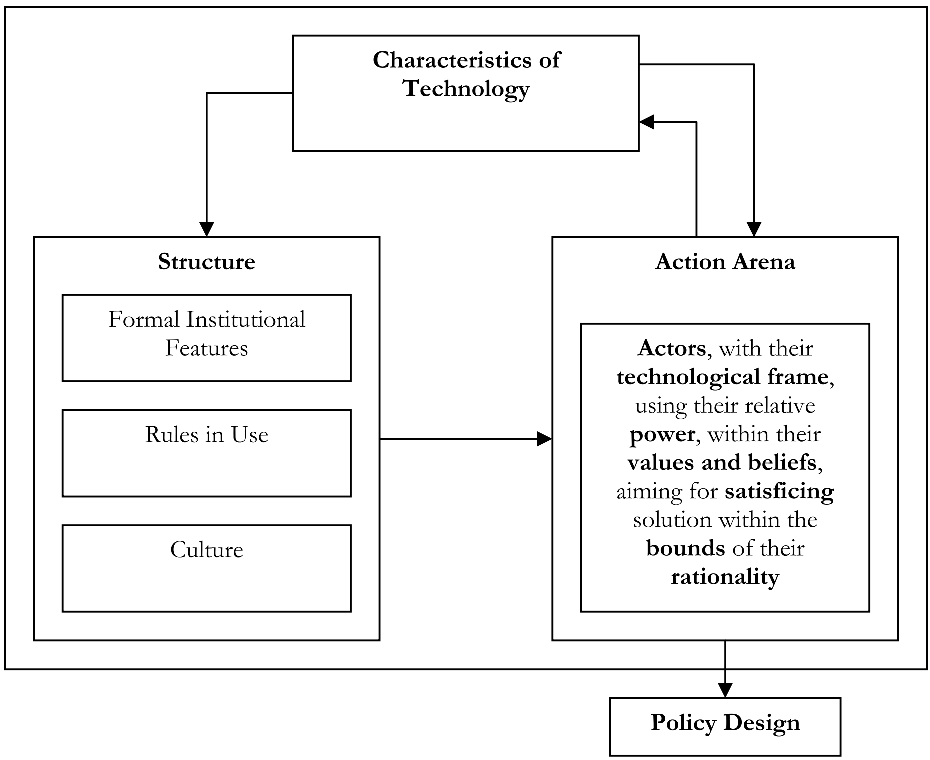

Figure 6.2: Conceptual Framework of Policy Design

Summarizing this means that there is an action arena, in which interaction is influenced by formal institutions, rules in use and culture. The action arena is also influenced by technology which, after it is shaped by the actors, constraints and facilitates the actions in the action arena through the technological frames the different groups of actors have.

Once established, the technology will influence the structure. In the action arena several groups try to push their values, which could conflict with values held by other groups, forward in order to come towards a policy design matching their values. They do so within their technological frame and with their relative power. All actors are limited in the degree of rationality they can demonstrate. They will aim for a satisficing solution; first because time and resources are scarce, second because they know consensus has to be made. Finally agreement will be reached and one alternative will be chosen as the alternative that will constitute for the policy design.

Now both the conceptual frameworks have been constructed and explained they will be used to analyze the case studies which will be conducted. Below the justification for the research methods and techniques will be explained and elaborated on.

6.5 RESEARCH DESIGN

The research design is dependent on several factors, the most important one being the goal of the research; secondly also the epistemological position is important.

When looking at the goal of this research it has become clear that this research aims to provide for an understanding of the way the perception and use of GIS influence processes of agenda-setting and policy design, their course, their content and their outcome. While this research holds an explorative character there is not one best way to research this. Therefore the two conceptual frameworks are used. These conceptual frameworks must be seen as a tool to analyze and research the influence of the perception and use of GIS on respectively agenda-setting and policy design. Next to being a tool the conceptual frameworks also account for a pattern of expectation on how technology and GIS could be looked at when dealing with matter of agenda-setting and policy design. The conceptual frameworks, as tool as well as pattern of expectation, can be tested against empirical reality in order to research the influence of the use and perception of GIS. It could happen that these empirical findings make way for adjusting and reconstructing the conceptual frameworks.

There exist a large number of research strategies which can all be very useful depending on the goal and the epistemological position of the research (Yin, 2003; Babbie, 2001; Seale, 1998; Silverman, 1993). In this research the choice is made to combine several strategies, this is called methodological triangulation (Yin, 2003; Babbie, 2001). This method involves that the strengths of several theories can be combined neutralizing each others weaknesses. By using multiple sources of evidence the construct validity of the research can be improved since operational measures for concepts can be found in more than one way (Yin, 2003).

This combination of different methods will consist of firstly examining existing material. As mentioned there is a lot of information on what GIS actually entails and there exists a body of knowledge on GIS used in public policy, even though this often deals with decision-making and evaluation this literature can be used for the purpose of having a starting point for agenda-setting and policy design.

A second method which will be used is case study research; six case studies will be conducted. This can make sure that empirical evidence can be directly found and observed. The material can be looked more intensively and more directly. Within the case studies the material that will be obtained is three fold. Firstly written information will be looked at; these can be legal documents, government reports, policy documents and news publications relevant to the sector, the layers of government and the GIS application. Secondly semi-structured interviews will be conducted with stakeholders in order to make sure their perception of issues and other actors can be researched. The choice for semi-structured interviews is based on the idea that perceptions, nuances and intentions of actors can be better researched, and more in-depth, by interviews than by surveys (Yin, 2003). The topics of the interviews can be viewed in appendix A and B. Finally some observation will be done. Interaction between actors will be looked at and the GIS application in the case study will be worked with. This is done to get a better understanding of the features of the application as well as to obtain knowledge about the relations within the sector.

When looking at the case studies it can be argued that multiple cases make comparison possible and therefore can account for a higher degree of reliability of the results of the research. This is so since by a multiple case study the models of agenda-setting and policy design are replicated in each case (Babbie, 2001; Yin, 2003). Furthermore a multiple case study approach can increase the external validity of the research. By conducting more than one case study findings can be generalized (Yin, 2003). The explorative character of this research makes the choice for multiple case studies justifiable. A very intensive research will be conducted on a relatively unknown phenomenon. This accounts for the opportunity to research a large number of variables at the same time, instead of a small number of variables with a lot of respondents (Yin, 2003).

It must be noted the six case studies will be used to come to an analytical generalization of the influence of the perception and use of GIS on agenda-setting and policy design. The cases will be compared on two levels. Firstly they will be compared between themselves, so findings of each case will be compared with the findings of other cases in order to come to a generalization. A second comparison will be internationally, cases from different countries will be compared with one another.

In choosing these case studies there are a number of selection criteria which are used to pick just these cases.

The first criterion is that the GIS application must be new in its field; the innovative character must be high. This can be justified by assuming that when an application is used elsewhere already and thus adopted the adopter might be aware of possible effects and might try to alter these. The direct influence of the perception and use of GIS then would be blurred. Therefore only cases in which the GIS application was new in its sort are used. This goes for all the chosen case studies.

A second criterion can be found in the policy cycle. Since this research deals with agenda-setting as well as policy design it is important to balance cases between the two. Therefore three cases are conducted in the field of agenda-setting, namely HIS and FLIWAS, the Riskmap and contagious live stock diseases, and three in the field of policy design, namely Virtuocity, particulate matter and Congestion Charging.

Thirdly the case studies must all encompass a different field of policy. This is important since the research has an explorative character in explaining the influence of the perception and use of GIS in agenda-setting and policy design in general, not in one specific field of policy. By spreading the case studies over different fields of policy it can be made sure that the outcomes of the research are not tainted by the culture or habits of one specific field of policy. Topics include: water management, internal risk assessment, agriculture, urban planning, air quality, public health and traffic.

A fourth criterion is the layer of government, in order to explain the influence of the perception and use of GIS on agenda-setting and policy design it is important to look not only at the national level. The outcomes could then be tainted since the national government has for example more money to spend on an application. Therefore the case studies are spread over the layers of government. Two of the cases are local, Virtuocity is conducted in the Dutch cities of Helmond and Tilburg and Congestion Charging is conducted in London in the United Kingdom. Two cases are conducted at a provincial level, the Riskmap is looked at in the Dutch provinces of North- and South Holland and particulate matter is conducted in the Dutch province of South Holland. Finally two cases are conducted at the national level, this is contagious live stock diseases in Germany and HIS and FLIWAS in the Netherlands and Germany.

As mentioned, six case studies will be researched, these include firstly the case of HIS and FLIWAS, in which a GIS application is used by the Dutch and the German government to predict and prevent flooding of rivers.

Secondly the Riskmap is looked at; this is an attempt of the Dutch government to use a GIS application to inform the public and first aid agencies on the locations of internal risks.

A third case study is contagious live stock diseases. Here the German government has used a GIS application to predict outbreaks of contagious live stock diseases and to prevent them from spreading.

Fourthly the case of Virtuocity in the Dutch municipalities of Tilburg and Helmond will be researched. Virtuocity is a GIS application which allows citizens to, in 3-dimensional view, look at redevelopment plans for their city, and can even vote for these plans.

The fifth case study will deal with concentrations of particulate matter in the Netherlands. By using a GIS application concentrations of particulate matter can be calculated but also effects of certain building plans can be predicted, on the basis of these outcomes a building plan might not be allowed to continue.

Finally the last case study will deal with congestion in London traffic. Here GIS is used to try to reduce congestion, effects of these measures are predicted and traffic is arranged by using the application. The selection criteria per case are pointed out in table 6.1.

Table 6.1: Case Studies

	Policy Cycle	Sector	Location
HIS and FLIWAS	Agenda-Setting	Water management	Netherlands and Germany
The Riskmap	Agenda-Setting	Internal risk management	The Netherlands, with an emphasis on the provinces of South- and North Holland
Live Stock Diseases	Agenda-Setting	Agriculture	Germany
Virtuocity	Policy Design	Urban planning	Municipalities of Helmond and Tilburg, Netherlands
Particulate Matter	Policy Design	Air quality and public health	Netherlands with an emphasis on the province of South Holland
Congestion Charge	Policy Design	Traffic	Municipality of London, United Kingdom

6.6 CONCLUSION

While a position in the technology debate was already chosen it becomes important to look at an epistemological position to look at not only technology but at reality as a whole. It is argued that social constructivism would be the most suited position to hold within this research. Previously it was explained that the core of the theory of social constructivism consists of the idea that everything in reality is shaped by humans, is a social construct, this can be seen in the function: X counts as Y in context C. Furthermore, after institutions are shaped and helped to shape other institutions, they, within the meaning they have been given, influence society.

The justification for this choice of epistemological position can be found the same way as the justification for the choice of social construction of technology. Firstly the main question demands for an approach recognizing the complexity of processes of agenda-setting and policy design together with an emphasis on perception of users of GIS. Secondly existing empirical data on the use of GIS in public policy suggest a social constructivist viewpoint would fit empirical reality best.

This means that technology, GIS, society and humans as well as the processes of agenda-setting and policy design, with their course, content and outcome, in this research will be looked at from a social constructivist viewpoint.

In this chapter the relevant concepts from social constructivism, social construction of technology and theories of agenda-setting and policy design have come together in a conceptual framework. These frameworks will be used to analyze the case studies to be conducted.

The core of the conceptual framework of agenda-setting can be summarized by stating that there is a policy sub-system, in which interaction is influenced by formal institutions, the nature of the issue and the policy window. The policy sub-system is also influenced by technology which, after it is shaped by the actors, constraints and facilitates the actions in the policy sub-system through the technological frames the different groups of actors have. Once established, the technology will influence the structure. In the policy sub-system several groups try to push their values, which could conflict with values held by other groups, forward in order to come towards a situation in which their preferred issue reaches agenda status. They do so within their technological frame and with their relative power. Finally agreement will be reached and one alternative will be chosen as the alternative that will constitute for the issue which reached agenda status.

The conceptual framework of policy design operates for a large part in the same way. This means that there is an action arena, in which interaction is influenced by formal institutions, rules in use and culture. The action arena is also influenced by technology which, after it is shaped by the actors, constraints and facilitates the actions in the action arena through the technological frames the different groups of actors have. The technology will influence the structure. In the action arena several groups try to push their values, which could conflict with values held by other groups, forward in order to come towards a policy design matching their values. They do so within their technological frame and with their relative power. All actors are limited in the degree of rationality they can demonstrate. They will aim for a satisficing solution; first because time and resources are scarce, second because they know consensus has to be made. Finally agreement will be reached and one alternative will be chosen as the alternative that will constitute for the policy design.

Having constructed these conceptual frameworks, in the next six chapters the empirical evidence from the case studies will be presented. Firstly three case studies dealing with agenda-setting will be presented, later three case studies in the field of policy design.

Chapter 7

How Flooding Streams towards Agenda Status

7.1 INTRODUCTION

After the flooding of a fairly large Dutch territory in 1993 and again in 1995 the Dutch government realized proper information on the risks of flooding was not available. Appropriate information was missing and a plan was made to design an application providing for this information. This application was named HIS (Hoogwater Informatie Systeem). Later a plan was made to incorporate HIS together with several other applications in one water management system named FLIWAS (FLood Information and WArning System). This would make sure that all information gathered by different water management organizations was shared and combined. With the new application a smooth communication would be possible and consequences in several fields were clear. Both HIS and FLIWAS are largely based on a GIS and used as such.

Naturally the both applications, HIS and FLIWAS are used in the case of flooding to communicate with one another and help with decision making on the spot. Also, because of the prediction of consequences HIS and FLIWAS can be used to prevent flooding by for example reinforcing dikes. By getting certain risks on the political agenda through the functions and effects GIS can account for, HIS and FLIWAS can have a profound influence on the process of agenda-setting.

In this chapter the case of HIS and FLIWAS will be looked at in order to understand the perceived influence of GIS on agenda-setting and policy design. This chapter forms the first of a series of six case studies which will bring us further in answering the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?".

In order to do so first in section 7.2 it will be explained what HIS and FLIWAS entail. It will be explained how they were designed and implemented and what the outcome of these processes were. This will ensure a proper understanding of the application. In section 7.3 HIS and FLIWAS will be looked at for the influence of the qualities and effects of GIS on agenda-setting. This will be done by analyzing the applications for the enhancing qualities and effects described in chapter 2. Next in section 7.4 the perceived influence of GIS on agenda-setting will be looked at, by using the conceptual framework of agenda-setting. First its building blocks will be looked at and finally the conceptual framework itself will be dealt with. What the case of HIS and FLIWAS will show us is that next to an arena in which issues of water management are being pushed towards, or blocked from agenda-status a second arena emerges. In this arena water management is not the subject of discussion but the application itself. In this arena policy has to be designed on how to program and implement HIS and FLIWAS. This arena will be treated as an arena of policy design as described in chapter 6. First the building blocks of the conceptual framework of policy design will be dealt with and finally the conceptual framework as a whole. In the end a conclusion will be given with an overview of the perceived influence of GIS on agenda-setting and policy design in the case of HIS and FLIWAS.

7.2 HIS AND FLIWAS

After the flooding of the rivers in the Netherlands in 1993 and 1995 it became clear that appropriate information on flooding was not available, the attention for appropriate water measures gained influence. Several issues seemed to be missing in the management of the flooding of rivers. There was no conclusive information on prediction of flooding, evacuation, and damage, and the flooding of 1993 demonstrated this to its full extent. Plans to make a new flood warning system in the Netherlands were born and after the 2004 tsunami, the hurricane Katrina, flooding the city of New Orleans in the United States, in 2005 and the Al Gore movie "An Inconvenient Truth" in 2007, alerting the world on the risks of global warming, attention for water management only grew.

This initiated the idea of making a new application on water management HIS, and later on another application which integrated several applications that already were in use, FLIWAS. First it will be discussed what the features of HIS and FLIWAS are, how the course of the process of implementation developed and how the outcome of the process of implementation turned out.

7.2.1 Features of HIS and FLIWAS

The Netherlands, always being in the geographical position dealing with the risks of flooding, after the floods of 1993 and 1995 developed several applications to deal with monitoring water levels, communication in case of flooding and warning systems. There existed several applications to deal with these issues.

First of all there exists an application named HIS (Hoogwater Informatie Systeem). There are three parties dealing with this application, firstly the Ministry of Transportation and Water Management, Waterway and Shipping Administration, which is part of the Ministry of Transportation and Water Management which is delegated with task of the practical execution of the water-state of the Netherlands, secondly the Watersboards, the government agency that deals with the water management in one specific area, and finally the governments of the provinces deal with this application.

The application has been developed since 1995 as a direct result of the flooding in 1993. In 2001 the first version of the application was launched and in 2003 a second version was made to deal with the shortcomings of the first version. The application uses a web-browser and is based on a GIS, since there are several users of the application; the application is made so the user can decide which information he would like to share with other users. The basis of the application is open source.

The aim of the application is to prepare for disaster; the application is divided into an operational segment and a policy segment. In the first place the application is able to monitor water levels. In a number of locations in the Dutch rivers instruments are placed which measure water levels and this is communicated back to the HIS application. When a water level shows to be high a warning sign will come up. HIS places these signs in a logbook and is also able to communicate this data to other agencies. Secondly HIS is able to predict scenarios of flooding; it will demonstrate the scenarios on an interactive map, like a movie. When a dike breach occurs HIS will not only predict which areas will be flooded, but also when in time and how high the water will be. Additionally it will predict how high the pressure on other dikes will be and whether they will breach as well. Naturally these predictions correspond with the information received from the monitoring segment of the application.

Thirdly HIS is able, on the basis of the predictions of the flooding scenarios to calculate the damage. This can be done in economic terms but also in terms of the environment and loss of landscape, this so a proper analysis of the dikes can be made. Finally HIS will not only calculate the damage in the terms mentioned above but also in terms of victims and evacuations. It will calculate how many people live in the potentially flooded area but also how these people should be evacuated. For example, it is important in times of flooding

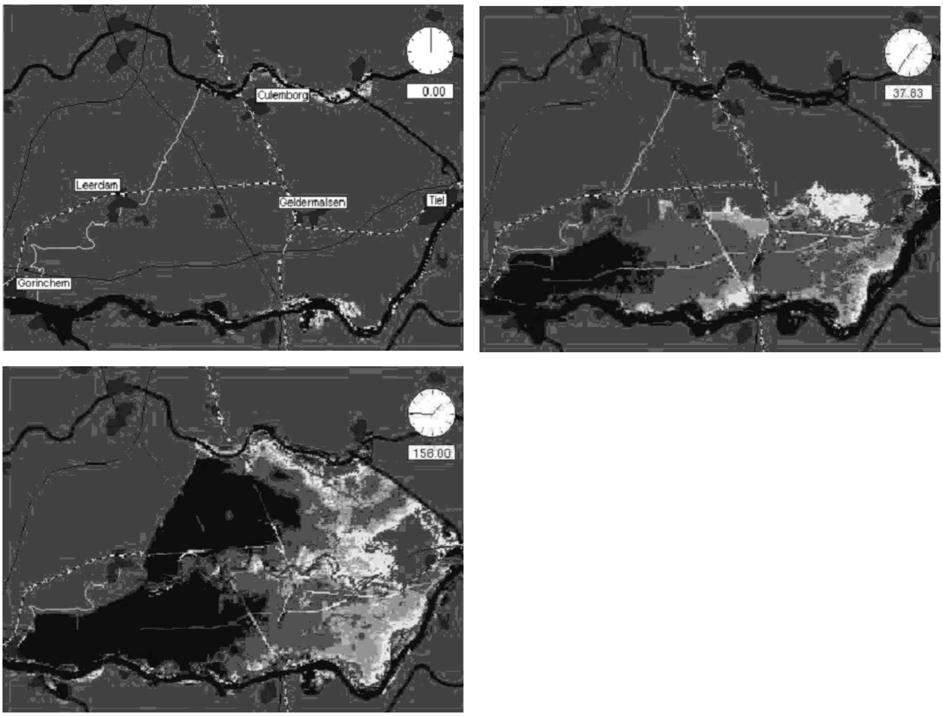

Figure 7.1: Flooding Scenario in HIS of "Tieler- en Culemborgwaarden" after 0.00 Hours, 37.83 Hours and 158.00 Hours (www.hisinfo.nl)

not to evacuate people over routes that will probably flood as well in a brief time. Additionally when making an evacuation plan one must consider the capacity of the routes.

Another application is Infraweb; the aim of this application is mainly communication. The application is used by all actors involved in water management. The application registers any calamity and makes sure the relevant actors are informed on this. Additionally Infraweb will register what actions which actor has undertaken already so all involved can see, real time, what is going on. The application also functions as a mail server by which all involved actors can communicate with each other. All the information is stored in a logbook module or an archive. At first the application was developed only for the water sector, but in 2005 the application is also used by other parts of government. The application used to be called Aquabel but as of 1997 it received its new name and also incorporated a GIS used for communication and making issues visible on a comprehensive map. Infraweb is like HIS, web based and is not only used by the same government agencies as HIS but also by police, crisis managers and agencies of disaster coordination and communication.

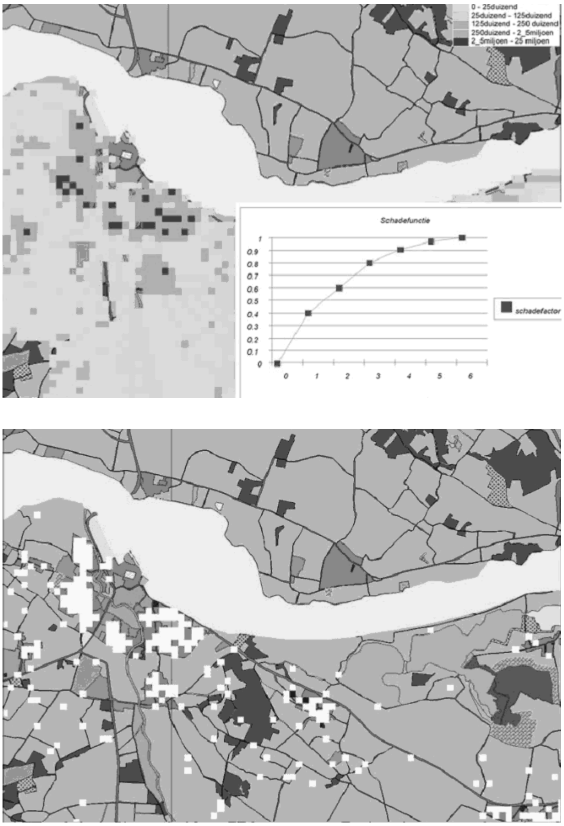

Figure 7.2: Simple View of HIS Damage Calculator (www.hisinfo.nl)

A third application widely in use in the Netherlands is GDH (Geautomatiseerd Draaiboek Hoogwater, Automated Script on Flood Water). This is an application used by water management professionals and the aim of the application is to provide for a script, a to-do list, in the case of flooding. The application is able to monitor water levels just like HIS and is able to register these levels and the actions undertaken in a logbook module just like HIS and Infraweb. Additionally it provides for the mentioned script of what to do. This script goes a lot further than a plan for disaster management. This application is only partially based on a GIS but is based on the web.

Finally another application is used, named Viking. This application is not only used by the Dutch government but is a joined application with the German government in the State of Baden-Württemberg and the Dutch government of the province Gelderland and the water management agencies. Most of the flooding in this area is a border crossing problem, since the rivers come into the Netherlands through Germany. The Viking project uses HIS to predict flooding and has the same features as HIS but is not able to monitor water levels, and does not include the damage calculator. Additionally to the features of HIS it does have a communication module in which communication as in Infraweb becomes possible. The application is completely GIS oriented and web-based

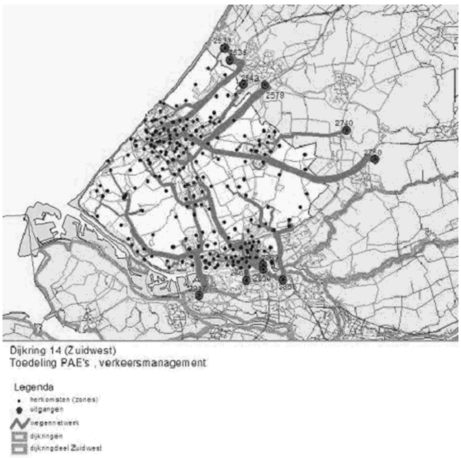

Figure 7.3: Simple View of Traffic Management in the Evacuation Calculator in HIS (www.hisinfo.nl)

Next to the larger applications used for water management in the Netherlands several organizations also use their own smaller applications. In 2004 it was decided there were too many different applications in use in water management and that one umbrella application should be developed. This application should incorporate all of the functions held by the other applications. This would prove to be a lot more convenient since everybody would work with the same application. The slogan for this plan would be "The right information on the right place at the right time." and the application would be named

FLIWAS (FLood Information and WArning System). The aim of the application would be to develop and implement an application of flood management on a trans-national level. It would have to help to increase knowledge on the risks of flooding and help to alert the public. Additionally it would have to help cooperation between the water management sector and the disaster management sector. The general idea was to make flows of information in case of flooding not only controllable but also to keep them that way. The application would incorporate all the features of the applications described but would have the additional feature of getting extra geographical data by satellite on among other things, the weather.

The application would also have to be available for the public, this for the purpose of increasing awareness of the risk of flooding. The application was supposed to have an expert-filter which would make sure the information which should be available for the public will be available for the public and the information which should not, would only be communicated further to experts. The application will be a GIS application and will run completely on a web interface with an open source license.

As figure 7.4 demonstrates all the features of the existing applications were to be incorporated in FLIWAS. Dissemination to professionals and to the public will be a new programmed application in FLIWAS. The script application will be taken out of the old GHD. For the monitoring function HIS will be used which will be built in FLIWAS. InfraWeb will be build into FLIWAS as well to account for the logging and the messaging function. The flooding scenarios, the evacuation calculator and the damage calculator will be made available through the HIS application built in FLIWAS. For VIKING, HIS was used already but the professionals using VIKING will, at the time, help to train other professionals in using FLIWAS since the applications are the same for a large part.

7.2.2 The Process of Implementation

After explaining the features of both applications, HIS and FLIWAS, it becomes important to look at the implementation process of both these applications. First several partners within the field of water management must be distinguished; it will become clear the water sector in the Netherlands is highly dispersed. On the Dutch side of HIS and FLIWAS first of all the ministry of Transportation and Water Management is involved, secondly Waterway and Shipping Administration, a part of the Ministry of Transportation and Water Management, which is delegated with task of the practical execution of the water-state of the Netherlands. Thirdly there are the Waterboards, the government agency dealing with the water management in one specific area. Finally the governments of the provinces and cities deal with this application. Additionally the Ministry of Internal Affairs is responsible for the communication of risks and disasters. Together with the Ministry of Transportation and Water Management they formed the TMO (Taskforce Management Overstromingen,

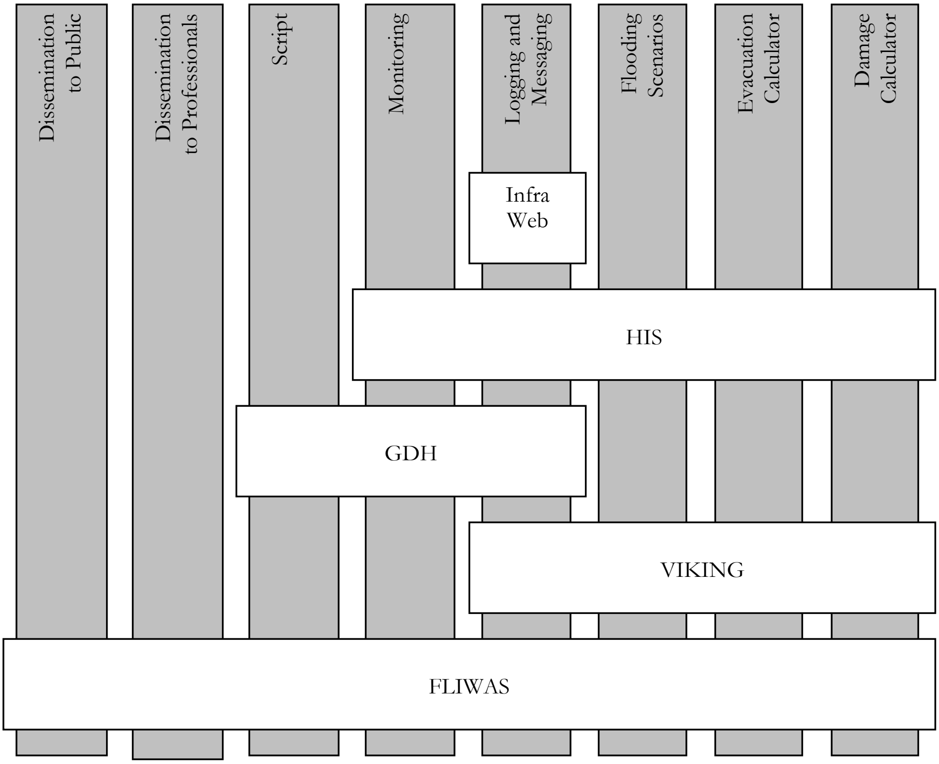

Figure 7.4: Integration of Existing Applications in FLIWAS

Taskforce Management Flooding). Their task is to organize flood management between the different government agencies. On the German side the Hochwasserschutzzentrale Köln, (the Flood Protection Unit in Köln) and the Regierungspräsidium Karlsruhe which represents six local authorities along the Rhine, are present.

As of yet (2009) FLIWAS is partially implemented but HIS is already used for several years. While busy implementing FLIWAS all the involved parties are exited about the idea that everybody will work with the same information. But there are also some problems with the implementation of FLIWAS. Even though everybody is exited there are some problems with autonomy. Where the Netherlands would like to have InfraWeb as the dominant application for communication Germany would like to see the application already used in Germany to be incorporated in FLIWAS. Neither government seems to be very willing to give up their application and to invest in training their water professionals in using another application. This is causing some delay in the implementation of FLIWAS. A planned drill to establish how the application was functioning kept being delayed and was supposed to take place in December 2007. This drill was actually conducted in November 2008. The integration of all the different modules in FLIWAS and the autonomy issues as described above are, according to several policy-makers 'every public administrators nightmare'.

Another issue that further complicates the implementation of FLIWAS is that the water sector is so much dispersed and therefore it proves to be very difficult to communicate and negotiate with one another. All the different organizations in the water sector seem to view FLIWAS from a different angle and have different views of what the application should add and what it should mean. It proves to be very difficult to get all noses in the same direction. This also accounted for the large delay in the final implementation of FLIWAS.

It must be mentioned that the general belief in the water management organizations in the Netherlands is there are too many different ICT systems in the water sector, these should be brought back to only a few.

During the technical implementation of FLIWAS by Royal Haskoning it became clear that the easiest way to do this would be by using a rapid application design. A demo would be given to users right away and it could still be adapted to their wishes. In this way users get a chance to learn how to use the application. It became clear that different users need different levels of detail which could be accounted for. After the first design of HIS a redesign was made in which several new whishes of users where incorporated. While waiting on the final implementation of FLIWAS most users are very content with the usability of the application.

7.2.3 The Outcome of the Process of Implementation

After some trouble during implementation, as described above it becomes clear that HIS will be used further in Germany as well as in the Netherlands and that the first version of FLIWAS was implemented in 2008. A drill was organized and the general mood when evaluating this drill was positive.

The autonomy problem in which Germany did not want to use InfraWeb but its own communication module could not be solved. Germany put its own application in FLIWAS and the Netherlands will remain using InfraWeb. This does some damage to the goal of letting everybody work with the same application.

In terms of the added value of GIS in HIS and FLIWAS most organizations dealing with water management agree, by using maps but also the interactive movies it becomes easier to communicate with policy-makers on all levels. In preventing flooding and during a flood it can be explained easy and unambiguously what is going to happen so measures can be taken. Before using HIS and FLIWAS is was very difficult to make policy-makers understand what was going on or under which risk they were. Next to this visualization function according to respondents also communication became a lot easier between organizations. Whether communication or visualization is the key function of HIS and FLIWAS is not clear, some organizations see HIS and FLIWAS as a communication application, others as a tool for visualization.

Additionally all parties agree that with HIS and FLIWAS, especially while using the GIS interface, policy-makers can become more aware of the risks of flooding and the possible damage it may cause. This also counts for the public, while some of the features of HIS and FLIWAS are supposed to be accessible for the public; the hope is this will cause more public awareness. There is some discussion on how much the public should see of the results HIS and FLIWAS produce. Negotiations are being held installing a flooding-insurance by which citizens can insure themselves against the financial risks of flooding. The fee for the insurance would depend on how high risk the location of their house would be, calculated by HIS and FLIWAS. There are worries though that this kind of information would cause a problem in the real estate market by which a lot of homes would dramatically decrease in value because of their risk of being flooded.

Furthermore HIS and FLIWAS have had a profound impact on public policy. First of all because HIS and FLIWAS are able to let professionals try out scenarios and then predict consequences. Several instances of dike reinforcement were placed on the agenda and were implemented after HIS predicted dangerous scenarios. In this way HIS generated political attention but also the financial means to have the reinforcement happen.

HIS and FLIWAS are already becoming important instruments for spatial planning; they become more and more important. Governments can now clearly see which part of their territory is at serious risk and can decide not to build there; additionally routes for evacuation can be calculated into spatial planning.

It must be noted that even though most policy-makers are very enthusiastic about HIS and FLIWAS, at some points these applications cause to make conflicting interest visible. For example in Lent, a city in the Netherlands in which the local government had decided to build a new neighborhood. This neighborhood was to be built in an area for which HIS calculated that this would be the best area to use to broaden the river to give it more space and prevent further flooding. The government of Lent was not very pleased with this and held the opinion the river could be broadened somewhere else. The Ministry of Transportation and Water Management decided that this was actually the best place to broaden the river and the building of the neighborhood had to be canceled. Another instance of conflicting values is in the city of Gouda in which a neighborhood is built in the floodplain. The city of Gouda claims they had no more room to expand and that this was the only way they could expand. The water sector, almost completely, agrees the risk, as calculated in HIS and FLIWAS, is unacceptable and the situation for the inhabitants is so dangerous that this should not have been allowed. This however did not have the consequences as it did in Lent.

Finally the water management sector is very displeased over the fact that water management is not very high on the political agenda in general. They hope by using HIS and FLIWAS they can make politicians as well as policy-makers and the public more aware of the water problems in the Netherlands. As for reasons water is not a very popular topic answers from different organizations in the water management sector are different. Mostly it is believed that because there have not been any large incidents Netherlands in terms of flooding recently, people are just unaware of this risk. Another explanation holds that the water management sector is too complex and that media for this reason do not write or broadcast on it anymore. This could also be caused by the idea that water is not politicized and therefore does not get a lot of media attention. All organizations do agree that, only for a short amount of time, hurricane Katrina as well as Al Gore's movie did put water on the agenda

7.3 GEOGRAPHICAL INFORMATION SYSTEMS IN HIS AND FLIWAS

After explaining what HIS and FLIWAS entail and how they are used, the process of implementing them and the outcome of this process it is important to really look at what the meaning of GIS is in these applications. The enhancing qualities and effects of GIS identified in chapter 2 will be used for this purpose.

Firstly because of GIS, in the case of HIS and FLIWAS, integration has occurred on two levels (Bekkers & Moody, 2006; Lips et al., 2000, Bekkers et al. 2005; Hout & Bekkers, 1998; Greene, 2000).

Firstly by linking different datasets, this made sure that information which was not visible before is visible now, in other words, new information is generated. HIS and FLIWAS do so by for example linking flooding of territory to available evacuation routes and to the number of people living in the area, a clear view can be given of what the appropriate route would be. Other instances of linking data sets are possible as well. In this way the features of GIS can very clearly provide for new information.

On a second level GIS accounts for integrations since the work processes of different organizations are more integrated, they are now standardized. With FLIWAS all the different organizations in the water sector now work with the same application which standardizes the processes between organizations. Also the process within organizations is standardized. While the application moves through several set steps each flooding incident will be treated by the same consequent steps. Evaluations of incidents and insight in procedures are now standardized.

A second quality of GIS which is present in the case of HIS and FLIWAS is calculation (Bekkers et al. 2005; Bekkers & Moody, 2006; Moukomia, 2004). In especially HIS it becomes clear that calculation can be used in the most obvious way, namely calculation whether a dike will breach or what the damage or the number of victims in that case would be. But also different scenarios are able to be simulated. Policy-makers could simulate what would happen if they for example would enforce a certain dike instead of another. Consequences of each possible action can be given in this way.

The third quality of GIS is visualization, (Bekkers et al., 2005; Hamilton, 1996; Greene, 2000) this is very apparent in the case of HIS and FLIWAS. Through the presentation of the data in maps and interactive movies the situation in case of flooding, but also the situation in a simulation, becomes very clear to many. A map, according to all actors, explains more than a thousand words or a graph or table. Because of these visualizations consequences of plans can be explained better to policy-makers who do not have the ability to understand the large amount of very complex data in a graph or table.

Next to the qualities GIS are said to have GIS also have some effects. These effects are also present in the case of HIS and FLIWAS.

The first effect mentioned in chapter 2 is the effect of increased and improved communication (Bekkers et al. 2005; Bekkers & Moody, 2006; Haque, 1996). This is twofold, in the case of HIS and FLIWAS firstly the communication between experts in the field improved. This can be found in the fact that now all organizations in the water management sector use the same application. Information is more easily communicated since every organization can see what the other organization is doing. Where formerly a regular e-mail application would be used as communication device, now the InfraWeb module in FLIWAS will arrange this, communicating the right information to the right organization. Secondly the communication between experts and government has improved. Communication between the water sector and policy-makers on the local and provincial level becomes a lot easier. Because of the visualization quality GIS presents data in the form of a map, the complex issues of water management can be more easily communicated to people who do not have a lot of knowledge of water issues. Through the interactive movies situations to prevent flooding, but also in a situation of flooding, the actual developments can be communicated to people who would formerly not understand the kind of data presented to them.

A second effect of GIS is increased transparency (Bekkers et al. 2005; Carver et al., 2000; Moukomia, 2004; Overchuk, 2004). This effect is twofold as well, firstly work processes become more transparent in the case of HIS and FLIWAS, this can be attributed to the quality of integration. Because each organization knows exactly what all other involved organizations are doing the process itself becomes transparent. Furthermore since the process through FLIWAS has become standardized, each situation must follow specific steps, it has become very transparent what to do when a situation occurs. Secondly the transparency of the policy problem itself increases due to GIS. Because of the simulations HIS makes it possible the problem of flooding can be looked at from different angles. Each alternative can be broken down and the consequences can be predicted through the calculation quality. Therefore the problem itself has become more transparent since insight in this problem can now be obtained more easily.

7.4 HIS AND FLIWAS AND AGENDA-SETTING

After looking at the perceived qualities and effects GIS are said to have and linking them to HIS and FLIWAS, it becomes time to dive deeper into the processes of agenda-setting which have occurred in the HIS and FLIWAS case. In order to look at the influence the perception and use of GIS has on agenda-setting processes the conceptual framework as developed in chapter 6 will be used to analyze the case of HIS and FLIWAS.

7.4.1 Concepts of Agenda-Setting

Before moving to the conceptual framework of agenda-setting first the different variables taken from the existing models of agenda-setting must be looked at, since they form the building blocks for the conceptual framework. First mobilization of bias will be dealt with, next conflict of values and power, fourthly formal institutional features, next the nature of the issue and finally the policy window.

Mobilization of Bias

The first building block of the conceptual framework of agenda-setting is mobilization of bias. This is the way some issues are organized into politics and some are organized out. In this way the system works in the favor of some and to the disadvantage of others (Bachrach & Baratz, 1970; Cobb & Elder 1972; Douglas & Wildavsky 1982; Schattschneider, 1960).

In the case of HIS and FLIWAS this can be seen very clearly. HIS and FLIWAS can bring situations to the attention of the water management professionals. However, they do not always manage to make a risk situation into an agenda point. For example, where HIS can clearly calculate the risk of building homes on the floodplains and all water professionals agree on the danger of doing so, they have as of yet not managed to put this point on the political agenda. It seems, to most water management professionals, that building more homes has more priority and serves a bigger societal need than safety. Local governments, in this issue, want to provide their citizens with more houses.

Expectations are that when the movies with flood risks would become available for the public they would also be more easily mobilized. This is one of the most important demonstrations of mobilization of bias. Some want the public to know about the flooding risks and thus want to give the public access to some of the information in FLIWAS, and thereby expand the water issue. Others do not think this to be a good idea because they do not want the public to be mobilized in water management issues. They fear that some areas would become undesirable to live for the public and the prices of real estate would suffer severely.

Conflict of Values

The second building block in the conceptual framework is conflict of values (Bachrach & Baratz,

1970; Kingdon, 1995; Sabatier, 1993). Here it must be noted the case of HIS and FLIWAS account for some conflicts in values between actors. The prime value on which conflict occurred was accessibility. The question was whether the public should be informed on the flooding risks through the interactive movies. Where the water management professionals would like to inform as many people as possible on the situation, and where they would like flooding risks being the main priority on the long-term political agenda, others do not. Especially local and provincial policy-makers do not see this as a priority and they do not believe that water should have such an emphasis. Therefore, there is some debate about whether to inform the public about the information generated in HIS and FLIWAS and, if so, how much information they should reveal.

Power

Power, another relevant concept in the conceptual framework of agenda-setting, is also one of the factors in reaching agenda status for an issue. An issue backed with more power is far more likely to reach agenda status than an issue that is not (Bachrach & Baratz, 1970; Sabatier, 1993; Dahl, 1961).

Here we can see in the case of HIS and FLIWAS the perceived power relations move for each issue. Where in the floodplains issue the water management professionals do not have the power to place this issue on the agenda, in the issue of Lent they did. In general for HIS and FLIWAS it can be said the applications help giving the water management professionals more power within the sector compared with before. This can be explained by several points. Firstly they have a better way of communicating problems and issues to policy-makers. Formerly the policy-maker was not very involved in water management itself because the issue was too technical and complex. Now with the movies the policy-makers are more easily informed and mobilized.

Secondly, because of the calculations and the linking of datasets water management professionals have more detailed information on what the alternatives are, the issues seem to be less ambiguous and therefore their reliability increases.

Thirdly, the water management professionals are the ones with the information, where this formerly was more dispersed between different organizations now it is centralized in FLIWAS. As a group the water management professionals can present themselves stronger in negotiations, in terms of relative power.

While local and provincial governments still have their share of power, visible in the floodplains issue, they, by the use of HIS and FLIWAS, lose some of this power to water management professionals.

Formal Institutional Features

On the structure side of the conceptual framework firstly the formal institutions come into play, they form the fourth relevant concept in the framework of agenda-setting (Bachrach & Baratz, 1970; Sabatier, 1993).

For the formal institutional features it can be said that they influence agenda-setting in the case of HIS and FLIWAS in two ways. First of all within the water management sector itself, the sector is very much fragmented and dispersed. It becomes difficult for water management professionals to organize themselves and become a dominant partner in agenda-setting negotiations. Since they are often all looking at different issues they cannot make themselves a powerful group. Secondly often water management professionals are not included in negotiations on plans. Mostly on the local level where spatial planning occurs, water management professionals are not invited to communicate with policy-makers on the consequences of plans for flooding risks. In this situation, they do not have the chance of placing their issue on the agenda or prevent another spatial planning issue to be discussed.

It must be mentioned that the first reason given, the fragmentation of the water sector, is reduced by the usage of HIS and FLIWAS. Now with the use of FLIWAS all the water management professionals communicate easier and also all have the same information. They can form a group more easily.

Nature of the Issue

The second concept on the structure side of the conceptual framework of agenda-setting, the nature of the issue, as opposed to the content, forms the fifth important variable in the conceptual framework of agenda-setting. Where the content deals with what the case is actually about, the nature deals with five dimensions of the case by which expansion to a relevant public can be explained. Expansion to a larger public, according to Cobb and Elder, would ensure agenda-status (Cobb & Elder, 1972).

When looking at the five dimensions of an issue, in this case HIS and FLIWAS, we see in the first dimension, the dimension of concreteness versus abstractness, HIS and FLIWAS move more to the side of concrete. The issue is unambiguously and not very abstract; therefore it should not expand easily. People are more likely to find their own opinion matching something abstract than something concrete, so the HIS and FLIWAS case will therefore not expand easily on this dimension. On the second dimension, the dimension of general versus specific, HIS and FLIWAS move more towards general. It is not very specific or peculiar; this will make it expand more easily. HIS and FLIWAS affect a lot of people, where a very specific issue does not and only affects a few people, therefore HIS and FLIWAS, according to this dimension have the potential to expand easily to a large public. The issue, on the third dimension, enduring versus short-term, is very enduring and not a short term issue, this would make it more expandable. While water management issues will probably be one of our concerns for a long time in the future, people are likely to engage in this, a short-term issue is less likely to attract attention from a large group since it will only affect them shortly. On the fourth dimension, the dimension of complex versus simple, the issue is definitely very complex. Water management has always been a very technical issue, now by using HIS and FLIWAS and using its visualization function, the issue becomes a lot simpler to understand. Where complex issues do not expand quickly, HIS and FLIWAS can make sure the complexity reduces and the issue will expand more easily. Finally on the dimension of routine versus extraordinary issues we see that water management has been an issue in the Netherlands for decades and more. Therefore it will gain less attention than a new or extraordinary issue. It is not new and excitingly different so people will easily regard it as already noted and uninteresting. Therefore they will not be very willing to engage in making this issue an agenda point.

Summarizing this we can see the nature of water management issue makes it difficult to give an unambiguous answer to whether the issue will expand easily. Where formerly the complexity of the issue hindered expansion very much now by using HIS and FLIWAS this complexity is reduced and water management can be made comprehensive to many.

Table 7.1: HIS and FLIWAS on the Dimensions of Expansion

Dimension	HIS and FLIWAS	Expansion
Abstract vs. Concrete	Concrete	Less likely to expand
General vs. Specific	General	More likely to expand
Enduring vs. Short-term	Enduring	More likely to expand
Complex vs. Simple	Complex	Less likely to expand
Routine vs. Extraordinary	Routine	Less likely to expand

Policy Window

The last important concept in the conceptual model of agenda-setting is the policy window. For the policy window (Kingdon, 1995) neither an unambiguous statement can be made. When looking at the policy window two things must be mentioned. Firstly while all participants agree that hurricane Katrina as well as Al Gore's movie provided for a policy window in which they could push their ideas forward to the larger public, the opening was not long lasting, according to all respondents. At the time questions were raised in term of the possibility for something similar happening in the Netherlands and some extra financial means were generated for water management, but this was only short lasting. Policy-makers were not very alarmed and were not willing to change other plans in favor of water management issues. Respondents complain about the lack of attention and the lack of opportunity in government to push their plans on water management forward and to gain financial means.

According to respondents the public does not seem to be very alarmed by these instances for a long time, and seem to be very sure that their government will take care of water management appropriately. They do not seem to worry and were not specifically mobilized by the two events. Here too, the respondents complain about the lack of an opening of a policy window for a significant amount of time on the side of the public. The public seems to be very sure that their government will take care of their safety in water management issues and therefore they are not very willing to be mobilized.

The water management professionals claim that this is the main reason that water management is not on the political agenda, no incidents have occurred lately. There has been no single triggering event in the Netherlands that caused water management to reach agenda status. The public is not mobilized and neither are the media. Several respondents indicated that it would be a lot better if just something would happen and the media would be all over it. Now respondents have very difficult time getting media coverage.

Secondly when looking at the policy window, it is important to recognize that GIS itself, and therefore HIS and FLIWAS themselves, have accounted for a policy window to open. The sheer existence of these applications with their new possibilities accounted for an opening. Because of the new calculations, visualizations and simulations a situation emerged in which ideas could be pushed forward. Therefore the technology itself accounted for a policy window to open.

Here we can see that in terms of the variables of the conceptual model of agenda-setting that it is difficult for water management professionals to mobilize public and government in potentially dangerous situations. Even though it sometimes does have an effect, as in the case of Lent mostly it proves to be a large hurdle. Power has shifted since the use of HIS and FLIWAS, the Ministry of Internal Affairs as well as the water management professionals gain power where local and provincial authorities have lost power. Conflict is also very evident in the HIS and FLIWAS case, where water management professionals do see water as a priority, local and provincial authorities do not, additionally the public does not consider water a pressing issue. The formal institutional features do influence agenda-setting since the water sector is much dispersed, but this can be reduced by the usage of HIS and FLIWAS. Finally we see the opening of a policy window, according to respondents, has not lasted long enough for a proper opportunity to push water forward on the political and public agenda. The existence of HIS and FLIWAS however, has accounted for this opening.

7.4.2 The Influence of HIS and FLIWAS on Agenda-Setting

After looking at the variables making up the conceptual framework of agenda-setting, the building blocks so to say, and referring them to the HIS and FLIWAS case now the conceptual framework of agenda-setting can be looked at in relation to this case.

As explained in chapter 6 the conceptual framework of agenda-setting exists of three parts and four channels of interplay.

Starting at the first part there is the policy sub-system (Sabatier, 1993) several parties can be distinguished in the policy sub-system: the Ministry of Transportation and Water Management and the Ministry of Internal Affairs, the Waterway and Shipping Administration, the Waterboards, the Provinces, the cities, the Hochwasserschutzzentrale Köln, the Regierungspräsidium Karlsruhe, Royal Haskoning and the public. These parties can be further divided into in advocacy coalitions, in agenda-setting issues the Ministry of Internal Affairs, government organizations dealing with water in one specific area, the Waterboards, the TMO and Hochwasserschutzzentrale Köln form the advocacy coalition we will further name the water management professionals. Secondly the Provinces, the cities in the Netherlands and the Regierungspräsidium form an advocacy coalition which we will term the local authorities. The Ministry of Internal affairs forms a separate advocacy coalition, because their department of crisis communication tends, in terms of values and beliefs, to be linked to the water management professionals but because they serve other values as well they need to be placed separate. Furthermore Royal Haskoning forms an advocacy coalition, while being the technical developer of HIS and FLIWAS and finally the public forms a coalition.

In the policy sub-system the different advocacy coalitions function within their technological frame. This frame holds their beliefs, expectations and assumptions on the technology (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995; Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The water management professionals view HIS and FLIWAS more as a visualization and calculation device, the local authorities together with the public mostly view HIS and FLIWAS as a communication device. The Ministry of Internal Affairs together with Royal Haskoning recognizes both functions and does not consider one to be dominant over the other. Furthermore all the actors in the policy subsystem use their relative power to gain agenda status for their issue (Bachrach & Baratz, 1970; Cobb & Elder, 1972). It was established that the water management professionals gained significant power over the local authorities and that Royal Haskoning and the public do not account for a powerful group in agenda-setting issues. This needs to be kept in mind when looking at the framework further. The advocacy coalitions push their ideas forward to gain agenda status within their values and beliefs. The conflict between different advocacy coalitions lies mostly there, where the water management professionals want to inform as many people as possible on the risks by making the results of HIS public. Where they believe water should have a very large priority, local authorities do not.

Summarizing this we can see that the water management professionals in all actors' perceptions have a large deal of power. Especially because now with HIS and FLIWAS they can communicate the information they own much more easily. Most of the conflict within the policy sub-system occurs between the water management professionals and the local authorities.

The second part of the conceptual framework for agenda-setting deals with the characteristics of the technology. Here it is important which meaning HIS and FLIWAS have been given. HIS and FLIWAS are perceived by the water management professionals as a tool primarily for calculation and visualization. The policy-makers perceive it primarily as a tool for visualization and communication. While both agree that all these functions are apparent within HIS and FLIWAS, the emphasis between the two are different. In terms of social construction of technology (Bijker, 1995) we can see that stabilization has occurred. This means that within the groups everybody agrees on the meaning of HIS and FLIWAS but that closure, a general acceptance between groups of what HIS and FLIWAS actually are, has not yet reached its ending. Even though all groups agree on the functions HIS and FLIWAS provide for, where the emphasis should lie is a matter of difference.

The third part of the conceptual framework deals with structure. This structure consists of three parts influencing the policy sub-system. First the formal institutions, (Bachrach & Baratz, 1970; Sabatier, 1993) as mentioned influence the water management professionals to push their values forward, and in that way benefit the local authorities. Even though the use of HIS and FLIWAS make this hindrance lessen. Secondly the nature of the issue influences the sub-system (Cobb & Elder, 1972). It is already claimed that on the basis of the nature of the issue it is impossible to give a unambiguous answer to whether water issues will expand easily. It must be said however that by using HIS and FLIWAS the issue itself became less complex and therefore easier to be expanded. Finally the policy window plays a large part (Kingdon, 1994). Even though HIS and FLIWAS accounted for an opening of a policy window by adding new possibilities, there is no situation in which water management professionals can push their ideas forward very easily. This benefits the local authorities to a large degree.

Looking at the conceptual framework as a whole there are four channels of interplay, connecting the three parts of the framework, as identified above.

Firstly there is the channel moving from the structure to the policy sub-system. Here the structure mostly limits the water management professionals in pushing their ideas forward, the formal institutions do so in the fragmentation, the nature of the issue does so because of the dimensions described above, both now reduced by the usage of HIS and FLIWAS. The policy window is not open wide enough to easily push ideas forward, thus hinders the water management sector in pushing their ideas forward. This benefits those who would not like to see water management issue expanding or being placed on the political agenda. Again, by the use of HIS and FLIWAS this is diminished.

Secondly a channel moves from the policy sub-system to technology. Here technology, thus HIS and FLIWAS, is made or shaped by the technological frames of the advocacy coalitions (Bijker, 1995, Orlikowski, 1992). Here we see while there is some debate whether HIS and FLIWAS are devices for dominantly communication or visualization that all actors in the sub-system agree that HIS and FLIWAS are both, the emphasis is only not agreed upon. Because of the technological frames HIS and FLIWAS become an artifact used for communication, calculation and visualization, helping communication between water management professionals and policy-makers. But we also see HIS and FLIWAS serving as a tool of power for the water management sector. Not only is the water management sector aware of this, but also the local authorities, they feel that HIS and FLIWAS are devices to detract power from them.

Thirdly the channel from technology moving towards the policy sub-system can be found. Although actors have shaped the technology and made it into what it is now, technology within the meaning it has been given facilitates and constraints human action in the policy sub-system (Orlikowski, 1992). Where HIS and FLIWAS are perceived by water management professionals as a device to expand their issue to the larger public by other actors it is in that way perceived as a hindering device. Next to this, HIS and FLIWAS within the meaning given to them have the power in the policy sub-system to unite the different organizations in the water management sector, making them one advocacy coalition with combined power. Additionally we see that because the water management professionals control HIS and FLIWAS. For them HIS and FLIWAS serve as a provider of power in terms of possession of information.

Finally there is the channel moving from technology towards structure (Giddens, 1984). After the actors in the policy sub-system have shaped technology and closure on the meaning of technology occurs, the established technology will influence the structure. New rules and laws might be made and it will be embedded in the culture. So the structure is a result of previous actions (Orlikowski, 1992). Here we see that HIS and FLIWAS, even though closure on the meaning of technology has not occurred, do influence the structure to a large degree. First of all by uniting the water management sector they can be perceived as a block in the formal institutions. Also the calculation and the possibility to communicate information properly to policy-makers made sure that water management professionals are taken more seriously and are more often invited to negotiations. Secondly the nature of the issue changed by using HIS, the issue became less complex and comprehensible to more people. Finally the technology is able to open the policy window by its own existence.

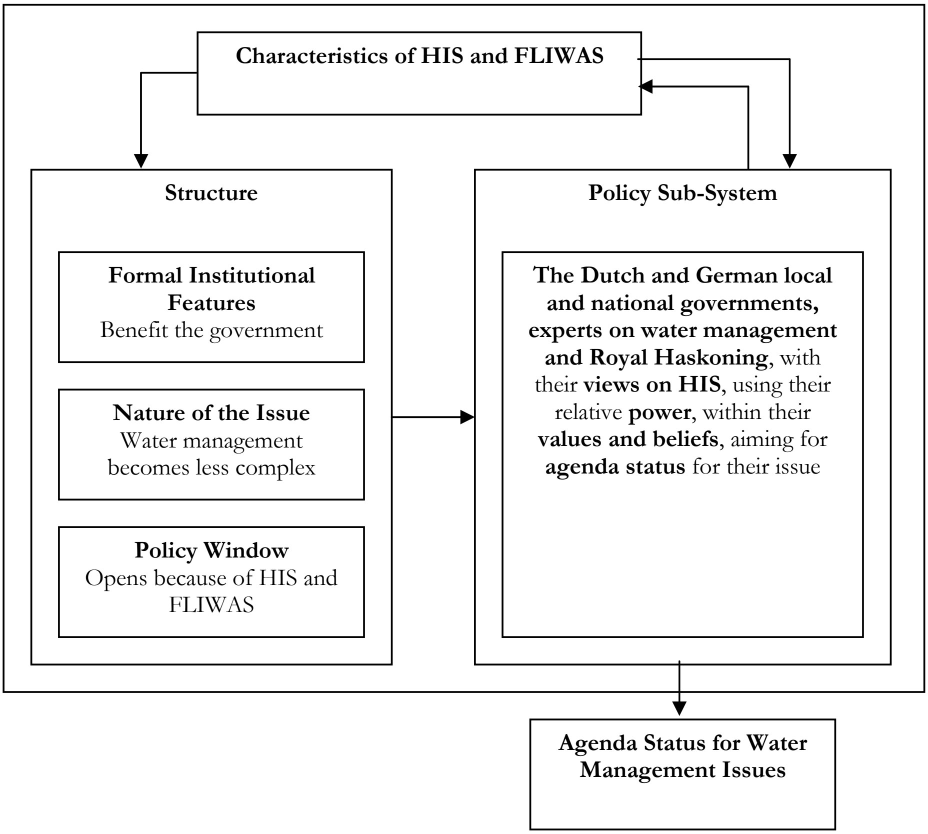

Figure 7.5: The Conceptual Framework of Agenda-Setting

7.5 A SECOND ARENA? DESIGNING HIS AND FLIWAS

What is very interesting is that after looking at the arena in which agenda-setting has occurred, we can find another arena. In the arena in which actors aimed to place or block certain water management issues on the agenda, the policy issues and solutions on water management are dealt with. If one would carefully look at the section in which the features of HIS and FLIWAS are dealt with one could find that there are a number of other issues and conflicts than those dealing with agenda-setting of water management issues. These are the issues of how to design HIS and FLIWAS, how to program the applications, who to give access to which information, which application to use, what the contents of the applications should be and so further. It is not so, as demonstrated above that the process of implementing and designing HIS and FLIWAS was a process which moved very smoothly, there were a number of conflicts and problems that needed to be resolved.

The policy design process of designing HIS and FLIWAS cannot be seen in the same arena as the agenda-setting arena described above. Not only because there are different actors with different interest at stake but also because the content on the issue itself is different. Water management issues are not what this second arena is about, this arena deals with the design of HIS and FLIWAS itself. A policy is needed in order to design and implement both applications. Therefore, next to the agenda-setting arena on water management issues a second arena has occurred, the arena in which policy is designed on how to design and implement the applications itself.

In literature on policy arenas a theoretical background for a second arena is difficult to be found. In this literature either there only exists one arena on a topic or there might exist two arenas but they are not so intertwined as is the case in HIS and FLIWAS (Sabatier, 1993; Ostrom et al., 1994). However, in the body of knowledge on implementing and designing information systems within organizations there is some evidence found on issues on implementation which can be very helpful in explaining this emergence of a second arena.

In literature it can be found that implementing information systems in organizations can be very difficult, because there are different stakeholders and departments within the organization. They fear the new information system will compromise their autonomy and control. Mostly it is established that the implementation and design of the information system will only be successful and without a lot of conflict if the application is enforced through the entire organization. Therefore, if an organization is organized in a decentralized manner this will not happen and the implementation will not be successful and will not fit the original aim. Those stakeholders who think they will lose autonomy will resist the new application and those who believe they will gain control will be in favor of the application (Markus & Robey, 1983; Goodhue et al., 1992).

In the case of HIS and FLIWAS the second arena can clearly be found, and must be looked at and analyzed in order to understand the perceived influence of GIS on agenda-setting and policy design. There is no theoretical background in literature on policy arenas for the emergence of this intertwined second arena. Therefore the theoretical background found in literature on the implementation on information systems within organizations will be used to understand why this arena emerges. In this section, the second arena will be treated as an arena of policy design, as explained in chapter 6, on the application of HIS and FLIWAS.

7.5.1 HIS and FLIWAS and Policy Design

Before moving to the conceptual framework of policy design, like above, first the variables taken out of the existing models, the building blocks of the conceptual framework of policy design, will be discussed. Bounded rationality will be dealt with first, secondly satisficing, thirdly conflicting values, fourthly power, fifthly formal institutional features, sixthly rules in use and finally culture.

Bounded Rationality

The first building block is bounded rationality. Bounded rationality is the idea that humans cannot account for all possible alternatives, predict all possible consequences and refer to all possible costs and benefits (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968). These bounds of rationality are very clearly to be found in the case of HIS and FLIWAS in several ways. Together with an increase in the bounds of rationality a decrease can also be found.

First of all there is an increase in the bounds of rationality in the way HIS and FLIWAS are designed by Royal Haskoning. While using a Rapid Design Application, in which first a general version is made and later each comment from users is integrated, it is already acknowledged that it is impossible to make a satisfactory design right away, that it is needed to do so in a trial-and-error way. The reason for this is because it is so difficult to make a design that fits right away because consequences of the design are so unclear.

A second point of increase in the bounds of rationality is the question of whether certain parts of HIS, and especially the movies, should be available for the public. The fear is that governments will be held accountable for not doing anything about the risk of flooding. Also the consequences for value of real estate are so unclear that opponents of making this available for the public claim that before consequences are clear the public should not be informed.

On other points the bounds of rationality seem to have decreased. The increased cooperation and integration of the water management professionals made sure that by using the same application that what is done by one organization is communicated directly to other organizations. This has lifted the bounds of rationality, at least partially. There is less insecurity on what other organizations are doing and what the responsibilities of the own organizations are. Several respondents mentioned that by designing HIS and FLIWAS knowledge of the own organization increased, since this all had to be incorporated in the applications in a systematic way.

It must be noted that even though in the design process of HIS and FLIWAS the bounds of rationality are largely present in the water management issues itself these bounds did decrease significantly. By the linking of datasets, the calculation and the visualization function of both applications, bounds in rationality only decreased. Water issues became much clearer, not only for professionals but also for policy-makers.

Satisficing

The bounds in rationality add to the practice of satisficing, instead of searching for an optimal solution a satisfactory solution is chosen (March, 1994). The practice of satisficing comes forward on several occasions. While the plan that the entire water management sector will use the same application is very ambitious, it becomes clear that policy-makers but also the water sector itself had to reduce this ambition and choose for a less than optimal solution.

This comes forward in the case when the German water management sector uses another communication module in FLIWAS than the Dutch water management sector. The original ambition was that the entire water sector, Dutch and German would use the same application. The Dutch and the Germans had to compromise on this and had to settle for a satisfying outcome, namely using a different application.

Another point is that most of the water management professionals would like to have the information HIS generates available for the public, this is not the case as of yet. The idea is that first FLIWAS will be used and later some of the information would be available for the public. This as well is a compromise, where local policy-makers, as well as the Ministry of Internal Affairs feared for the consequences of informing the public, the water management sector made themselves strong for full information. Again, there has been settled for a satisficing solution.

Conflict of Values

A third important concept, conflict of values, can also be found in the arena of implementing and designing HIS and FLIWAS (Etzioni, 1967). The design process of HIS and FLIWAS accounted for more conflicts in values than did the agenda-setting process.

A first conflict deals with autonomy. The Dutch and the German water sector came into conflict on which application to use as communication module in FLIWAS. Where this started of as merely a financial consideration this moved forward becoming an issue of autonomy of both sectors, as described above.

Secondly the conflict on whether the public should be informed on the information calculated by HIS was large. Where the water management sector wanted the movies to be available for the public, local authorities and the Ministry of Internal Affairs did not. This accounted for a conflict in terms of inclusion and exclusion and transparency.

Thirdly, the water management sector and the local and provincial authorities came into conflict. While using HIS and FLIWAS, the water management sector would have a very powerful tool with which they would be able to push their ideas on how to design the public space forward very strongly. The local authorities feared that they would lose some of their authority, especially in the field of spatial planning, when the entire water sector would be so integrated into a power block.

Finally, and surprisingly, where the water management sector itself in the agenda-setting arena seemed to operate as one group, in the design process of HIS and FLIWAS they did not. On the contrary, in the design process of HIS and FLIWAS it proved to be very difficult to get the different organizations in the water management sector looking in the same direction. Most conflicts occurred on what the emphasis should be in the different modules of FLIWAS and on which modules to use. Furthermore other conflicts were about what to share, not all organizations were willing to share their information with the other water management organizations, and after some conflict a compromise on this was found.

Power

Linked to conflict of values, power is an important concept in the conceptual framework since it can be used by actors to push their solution forward over another actor's solution (Etzioni, 1967; Dahl, 1961).

For perceived power a number of things must be mentioned. First of all there was an absence of power struggle between the technicians and the other groups. Winner argues that by using technology, technicians gain influence in the design process and power flows away from policy-makers (Winner, 1977). This was definitely not the case in the HIS and FLIWAS situation. This can be attributed to the Rapid Design Process by which the technicians adapted the application to the wishes of the users and the application thus became custom-made.

Other power struggles were far the more present. The Dutch-German conflict on which communication module to be used in FLIWAS was one of the biggest power struggles that caused a delay in the implementation of FLIWAS.

Secondly the struggle between the water management sector and the local and provincial authorities and the Ministry of Internal Affairs on the question whether the public should have access to the HIS movies became very apparent.

Furthermore a struggle in the Dutch water management sector itself can be found. This dealt with which modules to use in FLIWAS, where the emphasis should be, and on what information to share between organizations.

Finally there was a power struggle between the water management sector and the local authorities. The local authorities were afraid the water management sector would use HIS and FLIWAS as a powerful tool and would involve themselves into matters of spatial planning.

Summarizing this in terms of power we see the technicians did not gain any power over the other participants in the project. As far as the other parties are concerned it is to be found that the water management sector by the use of HIS and FLIWAS would gain a lot of power over local and provincial authorities. But the water management sector itself in the design process of HIS and FLIWAS fails to form one single block of power.

Formal Institutional Features

Moving towards the structure side of the conceptual framework of policy design first of all the formal institutional features must be discussed (Ostrom et. al. 1994). As far as the formal institutional features are concerned we can distinguish between three issues, one of which helping the design process of HIS and FLIWAS, the other two hindering the implementation.

First we see that the Netherlands always had had to deal with water management issues, the formal institutions and the formal rules are very much adapted to dealing with risks of flooding. This means, in the Dutch case, there always have been substantial financial means available for the water sector. Additionally, after the flooding of 1993 and 1995, the hurricane Katrina and Al Gore's film accounted for some attention flowing to the water management sector. Institutionally speaking, the Netherlands was able to generate the financial means but also the political willingness for an application like HIS and FLIWAS very easily.

This also has a downside for the implementation and the design of HIS and FLIWAS. Institutionally there are a lot of different organizations dealing with water management and flooding risks. This makes the water sector fragmented and since there are so many organizations dealing with water management it became very hard to have them all look in the same direction. This caused conflict within the water management sector itself which hindered the design process of HIS and FLIWAS.

Corresponding with this is that there are so many organizations, next to the water management sector itself, which have to deal with water management and flood risks that communication became very difficult. Institutionally there are, according to several respondents, too many organizations, with too many different interests, so communication and organizing the water management sector could not be done effectively at all. Above it is demonstrated that all these organizations did come into conflict with one another, and in this way hindering the design and implementation of HIS and FLIWAS.

Rules in Use

Additional to the formal institutional features the informal rules are very important as well, these are the rules in use (Ostrom et. al. 1994, Stone, 1997). There are several rules in use to be discussed in the HIS and FLIWAS case.

First of all it seems that before the idea of FLIWAS came to life, the communication between the different water management organizations did not occur at a frequent level. Now with the interaction between them needed for the implementation of FLIWAS we see that this rule has changed. Even though the communication between the different water management organizations did move everything but smoothly, they seem to have succeeded in forming a block when dealing with other organizations.

Another rule in use is that water management professionals were often not invited to negotiate on spatial planning on the local level. This rule seems to have changed as well. By using HIS and FLIWAS as a tool to push their ideas forward we see that now water management professionals are more often invited to take part in negotiations.

Culture

The final building block is culture, in the case of HIS and FLIWAS a few issues can be found in which culture influenced the policy design process (Ostrom et. al. 1994).

First of all a culture of risk aversion can be identified on the side of the local and provincial authorities and the Ministry of Internal Affairs. While the consequences of giving the public access to HIS were not clear to them, they prevented this from happening for the time being. These risks were primarily seen in the sector of real estate value.

Secondly a culture in which the water management organizations did not effectively communicate with one another can be found. This hindered the implementation of HIS and FLIWAS. Additionally there seems to be a lack of communication between the water management sector and other sectors, especially spatial planning. The leading opinion is that both of these communication issues will change when FLIWAS is embedded more. The water management sector itself will be further integrated then and they will have a more powerful tool to force themselves into the negotiation table in spatial planning.

Furthermore in the Netherlands a culture can be identified in which water management issues have always been very present. Dealing with water and risks of flooding has historically been one of the basic tasks of the Dutch government. Therefore an application like HIS and FLIWAS seemed a logical step to most government agencies. This made implementation a lot easier.

Summarizing the content of these building blocks in the case of HIS and FLIWAS it can be seen that in terms of bounded rationality on the one hand the bounds of rationality increase. Firstly on the side of the government, they cannot predict the consequences of showing the results of HIS and FLIWAS to the public. On the other hand the bounds of rationality decreased, the water sector became more integrated. On several occasions it was not possible to come to a consensus between all parties and a satisficing solution was necessary. There were several conflicts in values, on which communication device to use, on whether to inform the public, on the power struggle between the water sector and the local and provincial authorities, and on the modules to use. Fragmentation in the water management sector together with the magnitude of different organizations dealing with water hinders the implementation process. At the same time the Dutch history of dealing with water helped the implementation. Finally a culture of risk aversion can be found in informing the public for the fear of unforeseeable consequences.

7.5.2 The Influence of HIS and FLIWAS in Implementing

After explaining the content of the building blocks, the variables for the conceptual framework of policy design, the case of HIS and FLIWAS can now be looked at in terms of the conceptual framework. As explained in chapter 6, as for agenda-setting, the conceptual framework of policy design exist out of three parts and four channels of interplay.

The first part consists of the action arena (Ostrom et. al. 1994). This is the space in which all involved parties interact. Here we see that there are several groups of actors in the policy design process of HIS and FLIWAS. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

When looking at the different actors firstly the public can be identified, who has little knowledge on HIS and FLIWAS and does not have real power in the design process of HIS and FLIWAS. Secondly the technicians of Royal Haskoning form a group of actors who view HIS and FLIWAS as a tool for the water management sector. They try to adapt this tool to the wishes of their users. They never in the process executed any real power on the design process. Next the water management sector which in the agenda-setting arena functioned as one group, but do not in the design process of HIS and FLIWAS. When in conflict with other groups they are successful in forming one power block with significant amounts of power but internally they are much divided. The local and provincial authorities can be identified as a group. They fear power will be taken from them by the water management sector. They view HIS and FLIWAS as a tool for the water management sector of doing so, and they fear losing autonomy because of the use of HIS and FLIWAS. Finally there is the Ministry of Internal Affairs, mostly agreeing with the water management sector except for the issue of availability for the public.

The second part of the conceptual framework of policy design is the characteristics of technology, since in this arena the same actors are present, the same characteristics can be attributed to technology as in the arena of agenda-setting.

The third part of the conceptual framework of policy design deals with structure which influences the actions in the action arena. This structure is subdivided into three parts. Firstly there are the formal institutional features (Ostrom et al., 1994). The formal institutional features complicate the action arena, there are a lot of different actors and most groups of actors are able to use their power against other groups. Because of the fragmented character of the Dutch water sector, these groups internally do not form a coalition. Secondly the rules in use complicate this even further, (Ostrom et al., 1994) the lack of communication within the water management sector but also between the water management sector and other sectors hinder negotiations in the action arena. Finally we must deal with culture. (Ostrom et al., 1994) A culture of risk aversion hindered the public of getting access to the information of HIS and FLIWAS but the culture of dealing with water management issues generated the means needed in the action arena.

In the conceptual framework of policy design there are four channels of interaction which connect the three parts described above to one another.

Firstly the channel of the influence of the structure on the action arena, the content of this channel is described above.

Secondly there is a channel moving from the action arena towards technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artefact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992). Closure of this technology has occurred to some degree but not fully. Where the water management sector perceives HIS and FLIWAS as a way to put water on the agenda, inform the public and to gain influence in other sectors, the local and provincial authorities do perceive HIS and FLIWAS the same, but they regard this as partially negative. HIS and FLIWAS are thus shaped in this way as an artifact which works to the advantage of some and the disadvantage of others.

The third channel moves from technology back to the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992). This becomes very clear taking in mind what is said about the second channel. Now HIS and FLIWAS are shaped as being a mean of power for the water management sector, they will serve as such within the action arena.

Finally there is the channel from technology to structure. After the actors in the action arena have shaped technology and closure occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). This can be seen when looking at the leading opinion from water management professionals who claim that because HIS and FLIWAS serve as a tool of power they will unite more and communicate more with one another. In this way they will move away from the culture of lack of communication within the water management sector, this will account for lesser degree of fragmentation of the sector. The opinion of other sectors also is that the water sector will gain more influence over decisions with which they did not formerly deal. In this way, the culture as well as the rules in use might change, this might lead to a change in formal institutions.

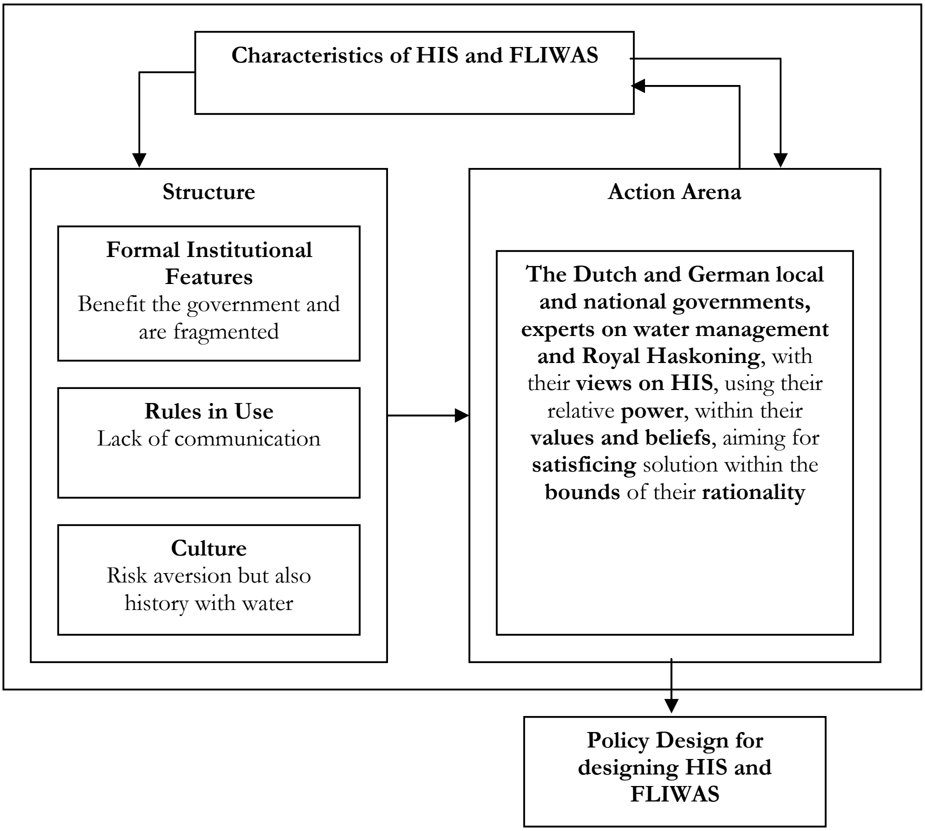

Figure 7.6: The Conceptual Framework of Policy Design

7.6 CONCLUSIONS

When coming back to the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?" first of all it must be concluded that when dealing with the influence GIS has we see that next to the arena in which agenda-setting occurs simultaneously another arena arises on how to design and how to implement the GIS at stake.

Starting of with the agenda-setting arena and the influence of HIS and FLIWAS a number of things can be concluded.

First of all HIS and FLIWAS had an influence on the process of agenda-setting in terms of the qualities and effects of GIS. This can be found firstly by looking at integration. By linking of different data sets new information was generated and by structuring work processes the water management sector not only gained information but could function as a block in negotiations of the agenda status of issues.

A second influence which can be attributed to GIS and the perception of GIS is found in the field of calculation. Through the new calculations that now could be made new issues emerged and existing issues could be backed with more power.

Thirdly the quality of visualization influenced agenda-setting processes since now very complex issues can be made understandable, making sure that water issues can be communicated clearly to policy-makers. This gives water management professionals the power to push their ideas forward.

Furthermore the GIS component in HIS and FLIWAS accounted for the possibility of communication within the water management sector moving smoothly. Because they had one communication device this made sure that in the process of agenda-setting the water management sector could function as a unitary actor and therefore exert more power. Secondly communication between the water management sector and other sectors became a lot easier. Prior to the usage of HIS and FLIWAS, water was perceived as a very complicated issue, but through the interactive movies and the maps water management professionals can make potential problems and plans more clear to policy-makers. Finally when the public would eventually be involved and gain access to the information in HIS it would be a lot easier to communicate water issues to them since the movies are understandable to many.

Finally increased transparency also influenced the agenda-setting process. Work processes have become more transparent in the case of HIS and FLIWAS, but the policy problem itself became more transparent as well. Because of the simulations HIS makes possible for the problem of flooding to be looked at from different angles. Each alternative can be broken down and the consequences can be predicted through the calculation quality. This made sure that these issues can obtain agenda-status far more easily than before.

It can also be seen that the use of HIS and FLIWAS has an effect on agenda-setting, by looking at the conceptual framework. First of all in terms of mobilization of bias, HIS and FLIWAS have a clear influence. By using HIS and FLIWAS a fair amount of power in the agenda-setting process flows over to the water management sector, taken away from local and provincial authorities. This can be explained by the monopoly like position of the water management sector over detailed information on flooding risks. Through calculation and the power to visualize situations clearly and communicate them understandably they are, more than before, able to place issues regarding water management, and everything linking to this on the agenda. The interesting thing is that this does not completely correspond with the reinforcement thesis, in which it is claimed that technology will reinforce those in power for the sheer reason that they designed the application and thus decide what the application can and should do (Kraemer & King, 1986). It can be noted that

HIS and FLIWAS give the water management sector a fair amount of power over areas in which they formerly had no access to the decision-making table.

Institutionally speaking it becomes clear that the water sector in the Netherlands is very fragmented which prevents them to a large degree to operate as a group and to organize themselves. Also it is hard for them to be included in negotiations not directly linked by water management. This hinders the agenda-setting influence of HIS and FLIWAS to be exerted to a large degree. However, by the use of HIS and FLIWAS the water management sector is forced to organize itself. They are more able than before to organize and form a block with which they can exert this influence.

What furthermore hinders HIS and FLIWAS to exert more influence on agenda-setting is the opening of the policy window not being wide enough. The sheer nature of water management itself is one that has always gotten attention in Dutch policy-making but not to the degree that it had a large power in agenda-setting processes. Even though a policy window in 1993 and 1995 caused the start of the HIS project and hurricane Katrina started the installation of TMO, water management is not on the public and political agenda. The complexity of the issue, even though reduced by the presentation in HIS and FLIWAS, hinders the agenda-setting power of HIS and FLIWAS even more. Expansion of the issue therefore becomes difficult, the public believes the government has flood risks covered and large water disasters have not been present recently.

Closure on the meaning of technology has occurred only limited, all groups agree, on a more or lesser degree on what HIS and FLIWAS are, only the emphasis differs. All groups agree that HIS and FLIWAS serve as a power tool for the water management sector but whether the emphasis should lie on communication or visualization and calculation is not clear yet. Additionally we see that once established as an artifact, HIS and FLIWAS can influence the structure. First of all by uniting the water management sector they can be more perceived as a block in the formal institutions. Next to this all the calculations and the possibility to communicate this properly to policy-makers made sure water management professionals are taken seriously and are more often invited to negotiations.

What is very interesting is that next to the arena of agenda-setting another arena emerged. This is the arena in which has to be decided on how to use HIS and FLIWAS, the arena of the design process of HIS and FLIWAS themselves. This arena is closely intertwined with the arena in which issues of water management will be dealt with, and this second arena is crucial to understand the perceived influence of GIS on agenda-setting and policy design.

In this arena of policy design on the content of the application itself it is to be seen that the bounds of rationality were lifted to some degree. The calculations HIS and FLIWAS can make and the consequences of different scenarios which can be predicted make sure of this. Secondly the water management sector has integrated better, sharing information and therefore being more aware of what other organizations are doing, made sure the bounds of rationality decreased. On other points the bounds of rationality increased. The Dutch government was so afraid of the consequences of letting the public know what the exact risks of flooding were that they decided not to make all information in HIS and FLIWAS available for the public.

In terms of power and conflict there is a lot more conflict than in the agenda-setting arena. Firstly the conflict on autonomy between the German and Dutch water management sector occurred, this issue could not be resolved and both parties chose for a satisficing solution. Secondly the struggle whether HIS and FLIWAS should be available for the public is found, where the water management sector believes this would mobilize citizens for their cause, other parties were afraid of the consequences of doing so. Thirdly there occurred a conflict between the water management sector and the local and provincial authorities. Where these local authorities are displeased with the amount of power HIS and FLIWAS give the water management sector in agenda-setting and policy design issues, the water management sector welcomes this power. Finally there is a conflict within the water management sector itself. While operating as a block to the outside, internally there had been a lot of conflict on how FLIWAS should be built, which modules to use and where the emphasis should lie. It proved to be very difficult to come to a consensus on this and therefore, among other setbacks, the implementation of FLIWAS is delayed. Technicians did not gain power in this process, contrary to what Winner claims (Winner, 1977).

On the structure side it becomes clear the Dutch culture and history of dealing with water management issues helped the implementation of HIS and FLIWAS. The government, acknowledging that the Netherlands always had water management issues and always will, was fairly quick in allocating the means, financially and other, to implement HIS and FLIWAS. But this had a downside as well. Since the rich history of Dutch water management issues the water sector is very fragmented, communication between different water management organizations was poor, too many interests are at stake and too many organizations involved. The general belief is that HIS and FLIWAS will integrate the water management sector and communication will improve. Furthermore a culture of risk aversion, especially on the side of the Ministry of Internal Affairs, hinders HIS and FLIWAS to be used to their full potential, this relating to the use of HIS for the public.

What does this all mean for the influence of the perception and use of GIS in processes of agenda-setting? The HIS and FLIWAS case leaves us with four main conclusions on this influence. Firstly it can be found that GIS helps integrate fragmented sectors, because of integration and standardization a sector which was formerly fragmented can now integrate. Furthermore this integration will make sure the sector can account for a block of power towards other sectors, being more able to place their issues on the agenda. It must be noted here the integration of organizations can account for conflicts dealing with autonomy.

A second conclusion that must be drawn is that by the calculation and visualization functions of GIS communication towards policy-makers proceeds smoothly, again making sure that those actors who control the GIS gain in power.

Thirdly it must be noted that while the bounds in rationality decrease because of integration, communication and visualization they increase on other points. Because the consequences of implementing a new application are so unclear the bounds of rationality increase. This leads to a culture of risk aversion which causes the GIS application not to be used to its full extent.

Fourthly it seems more conflicts occur in the arena in which the GIS application is designed than in the actual agenda-setting arena. This can be explained by the idea that actors anticipate potential power after implementation, so power relations in the agenda-setting arena are fixed already.

Chapter 8

A Mapping Hazard

8.1 INTRODUCTION

In 2000 in the Netherlands a fireworks factory exploded, this resulted in the killing of 23 and the injuring 950 people. This demonstrated that in the Netherlands citizens were not aware of potentially dangerous situations in their surrounding. Consequently they did not know what to do if one of these potentially dangerous situations would become apparent at one point, leading to disaster. Even more upsetting was that first aid agencies and risk communication professionals were unaware as well. They did not have the information on what was actually located in this factory. They did not know whether this would be dangerous to public health, or what other dangerous substances were located in the area of the factory to which the explosion could spread. When asking the municipality, it became apparent that they did not have a clue either.

This situation urged the Dutch government to develop a new strategy on risk communication for citizens as well as for professionals. And they chose the Riskmap as the way to do this. The application of the Riskmap, showing all potentially dangerous situations on a map and providing the viewer with extra information can be used in case of disaster. The Riskmap can be used as a means for communication and visualization and as a help in decision-making. By getting certain risks on the political agenda through the functions and effects GIS can account for, the Riskmap can have a profound influence on the process of agenda-setting.

In this chapter the case of the Riskmap will be analyzed in order to understand the perceived influence of GIS on agenda-setting and policy design. This chapter forms the second of a series of six case studies which will bring us further in answering the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?". Where the previous chapter dealt with agenda-setting issues first, so will this chapter.

In order to do so first in section 8.2 it will be explained what the Riskmap is and what it can do. How it was designed and implemented and what the outcome of these processes was. In section 8.3 the Riskmap will be looked at so a direct influence of GIS on agenda-setting can be found. This will be done by analyzing the applications for the enhancing qualities and effects described in chapter 2. Next in section 8.4 the perceived influence of GIS on agenda-setting will be looked at, by using the conceptual framework of agenda-setting. First its building blocks will be looked at and finally the conceptual framework itself will be dealt with, as described in chapter 6. The case of the Riskmap then will prove, just like HIS and FLIWAS to have a second arena emerge next to the first arena. Where the first arena dealt with agenda-setting issues on internal risk management, the second arena deals with designing the application of the Riskmap itself. Here the policy on how the Riskmap should be designed is made. This arena will be treated as an arena of policy design as described in chapter 6. First the building blocks of the conceptual framework of policy design will be dealt with and finally the conceptual framework as a whole. In the end a conclusion will be given with an overview of the perceived influence of GIS on agenda-setting and policy design in the case of the Riskmap.

8.2 THE RISKMAP

In 2000 in the Netherlands a fireworks factory exploded. This made clear that citizens were not aware of potentially dangerous situations in their surrounding. What was even worse was that first aid agencies and risk communication professionals were unaware as well. They did not have the information on what was actually stored in this factory. When asking the municipality, it became apparent that they did not have a clue either. This situation made clear the Dutch government needed a new strategy on risk communication for citizens as well as for professionals. And they chose the Riskmap as the way to do this.

In this section first the features of the Riskmap will be demonstrated and described, secondly the process of implementation of the Riskmap will be elaborated on and finally the outcome of this process will be shown.

8.2.1 Features of the Riskmap

As of March 2008 the Riskmap in the Netherlands was completely operational. What this means is the following, there will be two kinds of Riskmaps, one available for the public and one for professionals, both will function the same to a large degree.

The core of both Riskmaps is that they give an overview of all geographical locations which could pose a risk to public internal safety. The Riskmap will show instances like potentially dangerous substances, inflammable substances, explosive substances, toxic substances but also core points in transportation which would potentially cause disruption of public order, tunnels, large buildings, events which attract large groups of people, like demonstrations or soccer matches, vulnerable objects, like buildings which house a lot of people or buildings with people who are not able to evacuate themselves in case of disaster, and risks of natural disaster. All of which risks have a different symbol on the map.

The functioning of the map is fairly easy, one can access it from the internet, no password or registration is needed and this can be done from one's own home. The province in the Netherlands one would want to look at can be selected. On the map of the province all the different risks with their distinct symbols are shown. One can zoom in and out and select one of the risks. After selecting one of the risks the application shows what the risk entails, for example which substance is stored, how much of this substance is stored, who is responsible for the substance and the exact location, also the permits are listed. In this way professionals as well as the public can get a clear view of the risks in their surroundings.

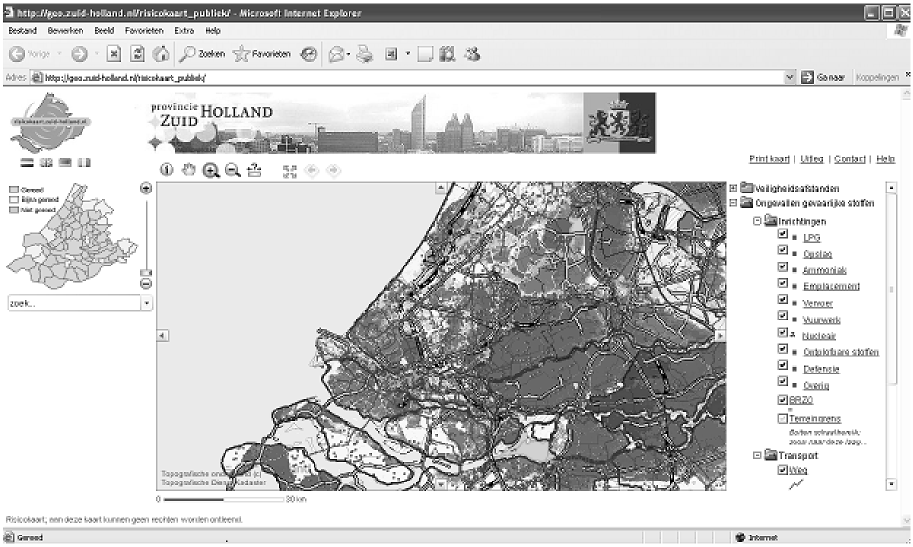

Figure 8.1: The Riskmap of the Province of South Holland (www.risicokaart.nl)

The Riskmap for professionals, among others, crisis managers, the fire department, police, military, register dangerous substances, traffic managers, is only slightly different from the map for the public. In the first place there is more information on each object, the technical specifications are mentioned, and in buildings more information about the groups of people is shown. Furthermore the professional map shows 'affect-distances', this is the area which would be affected were a gas station to explode, or a toxic substance released. This is based on calculations made on the wind, the spread of the specific substance, the fall out of the substance and so further.

The trigger for the Riskmap in the Netherlands started after a disaster in the city of Enschede in 2000, where a fireworks factory exploded. The citizens in the surroundings of the fireworks factory had no idea what was going on in the building, they were not aware that fireworks were produced there nor that they were stored there. Even worse, the local government had no real image of what was going on either. Crisis managers were unable to figure out at the spot which substances might have been released at the explosion. The Dutch government then decided that risks like these had to be inventoried better and had to be communicated to citizens more unambiguously. Several new laws added to this. The government now holds the explicit responsibility to inform citizens on possible risks in their surrounding; the Riskmap was the application to use for this.

The main goal of the Riskmap, for the public as well as for professionals is to provide for an accurate image of the potential risks in a surrounding. Additionally the Riskmap should be used as a communication device so governments can communicate risks to citizens in a clear manner. Furthermore it can help crisis managers and first aid professionals in case of

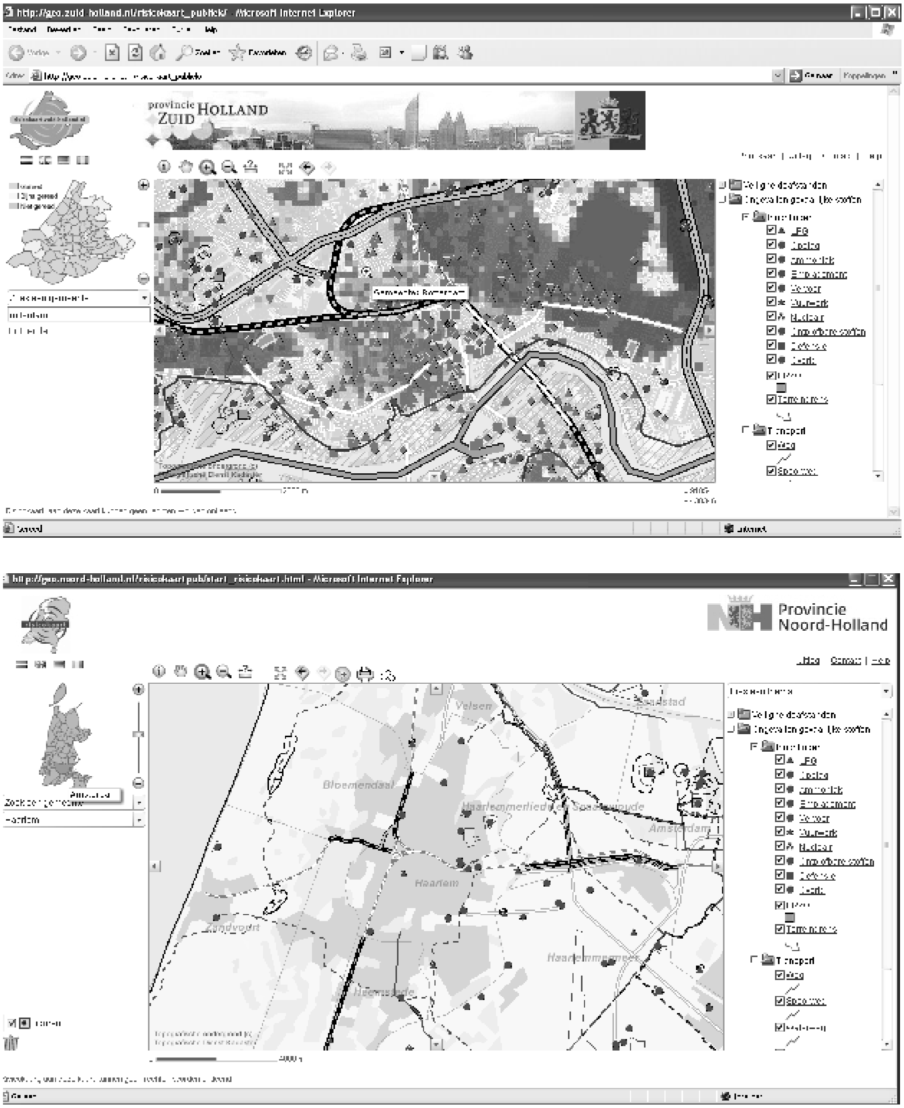

Figure 8.2: The Riskmaps of Rotterdam and Haarlem (www.risicokaart.nl)

a crisis to understand what the risks are and what they are up to. Additionally the goal of the Riskmap is to make a clear overview in general of all possible risks.

Not all risks are placed on the Riskmap; it is the national government who decides which risks should be on the map which should not. Only those risks are on the map which require, in case of disaster, a coordinated usage of several different organizations to help in the situation are on the map. This means that a dangerous substance which can cause multiple victims is on the map but a dangerous crossover is not.

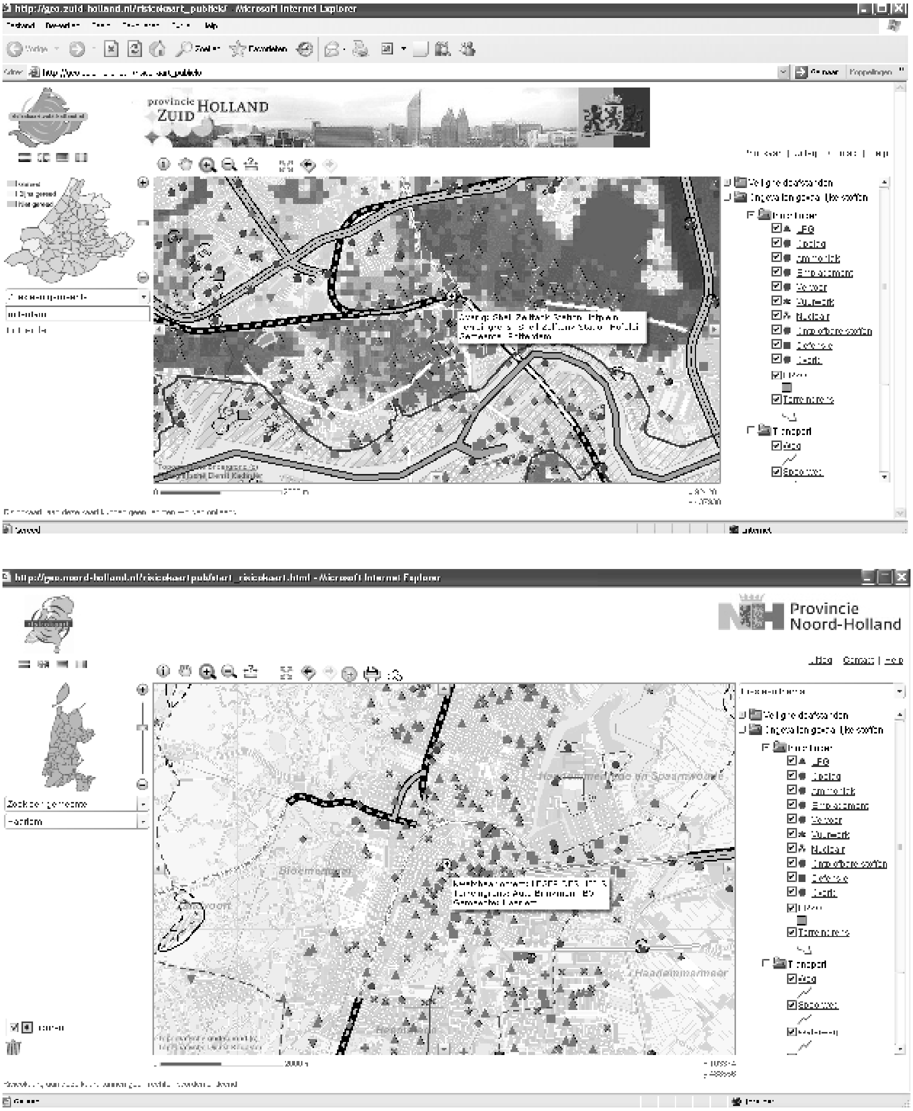

Figure 8.3: The Riskmaps of Rotterdam and Haarlem with Objects (www.risicokaart.nl)

There are several parties involved in the Riskmap, first of all the national government, they decided the Riskmap had to be installed and they are primarily responsible for the Riskmap, this falls under the Ministry of Internal Affairs. Secondly the provinces are involved, and with them the IPO (Inter Provinciaal Overleg, the Inter Provincial Organization), with them the first aid organizations and the water management professionals and the local governments of the cities, and the fire department and environmental organizations. The provinces make the Riskmap for their territory and they are responsible for the update and the functioning of the site. The local governments have the duty to provide their province with the data concerning their city. Furthermore the Ministry of Housing, Spatial Planning and the Environment is involved because prior to the Riskmap they took care of the registry of dangerous substances. Also the LOCC (Landelijk Operationeel Coordinatie Centrum, National Operation Coordination Center) which is responsible for crises which go beyond one region, is involved together with the GHOR (Geneeskundige Hulp bij Ongevallen en Rampen, Medical Help in Accidents and Disasters) are involved.

8.2.2 The Process of Implementation

The process giving way to the Riskmap started in the aftermath of the firework disaster in Enschede. The government needed a way to communicate risks towards citizens and also a better way of making sure first aid organizations, fire departments and crisis managers are up to date on what is happening on their territory. The idea of the Riskmap was born.

At first the idea was that each city would have its own Riskmap, the national government came up with this in the end of 2000. This plan quickly failed since at the time the Netherlands counted about 500 municipalities. The provinces, in the meantime, already started their own Riskmap,. The Ministry of Internal Affairs therefore decided that the Riskmap would be organized by province.

Several new laws made it possible the Riskmap would become operational, of which three most important. First of all the government must now be committed to investigate and register the storage of dangerous substances. This falls under the Ministry of Housing, Spatial Planning and the Environment in what is called the RRGS (Risico Register Gevaarlijke Stoffen, Risk Registry Dangerous Substances). Secondly municipalities are now obligated to make a risk-inventory in which they list all potential dangers on their territory. Thirdly the municipalities are obligated to inform their citizens on the risks on their territory.

In the implementation several organizations had to work together in order to make the Riskmap work. First of all the national government had to make a model for the Riskmap so the provinces could use the model to make sure each province worked with the same application. The provinces had to set up ways and possibilities to host the application and to update it regularly. Additionally they had to make sure that the municipalities handed in their information on risks at the right time but also that this information was complete. The Ministry of Housing, Spatial Planning and the Environment needed to be included to help out with the RRGS, local first aid organizations needed to be included and fire departments needed to help out as well, just like the LOCC. The technicians from Geodan were to make the application; since the application is national and legally very well defined they were very clear on what to do and could not overstep their boundaries. In the process the technology often did prove to be the factor in which problems occurred. This accounted for the implementation of the application to take time and there were many technical problems.

In the process of implementation the cooperation between different organizations proved not to be a problem but there were other concerns. First of all there was a large debate on whether the Riskmap itself would not pose a risk. With all information about explosives and toxic substances accessible for everybody over the Internet would we not invite terrorists to attack? This fear was very largely present but in the end it was agreed upon that whether a Riskmap would exist or not, terrorists would always be able to get this kind of information so this should not hinder the implementation of the Riskmap. Most actors also agreed the value of giving information to citizens about their environment should weigh heavier than a perceived terrorist threat.

Even though most actors felt this way, there was a large problem regarding the affect-distances. Now these distances are only on the professional map and not accessible for the public in full detail. At first this was not the case, they were also available for the public. The reason this changed came from a new actor, the Ministry of Economic Affairs. What happened was that while Dutch officials agreed that terrorists would obtain this information regardless of the Riskmap, international business cooperations thought otherwise. They believed, especially the petrochemical sector, that when this kind of information about their company would become public they would be a target for international terrorism. They slightly threatened to either move their business elsewhere or not to consider the Netherlands at all as location to move business to if the affect-distances would appear on the public map. While the Ministry of Economic Affairs feared they would do so and while this would be a threat not only to employment rates in the Netherlands but also to the Dutch economic position, the Ministry of Economic Affairs pressured the Ministry of Internal Affairs into taking the affect-distances off the map; this to the large protest of the provinces as well as the municipalities.

Another fear of municipalities was that citizens would start complaining. That they would try to pressure their municipalities in taking all dangerous substances out of their municipalities, that they would feel unsafe and would think they would be at risk twenty-four-seven. Even though municipalities largely felt this fear, nothing in the implementation of the Riskmap changed.

Furthermore in the implementation of the Riskmap the police department did not feel comfortable with the Riskmap at all, it was initially the idea that the police, together with other organizations, would use the map. The police feel that the map does not help their goal and does not provide the information they need. They do acknowledge the use in large events but the map cannot tell them for example in which neighborhood a burglar is active. The police therefore still use their own system which is also GIS based.

About a year before implementation of the Riskmap a study was done in order to measure the user-friendliness of the Riskmap. Professionals were shocked with the results. The study merely showed that citizens were not able to work with the application. The problem did not lie so much in the application itself but more in the geographical knowledge of citizens. In order to find ones city one must know in which province the city is situated. A significant deal of citizens was not able to identify their province and if they could they were not able to locate their city on the map. Additionally the Riskmap took too long to be loaded of which citizens thought it was annoying.

It also must be said that along the way of implementing the Riskmap, say from 2000 until 2008 we can see that several databases were successfully combined. Where this sometimes accounts for lots of problems, in the case of the Riskmap this moved on very smoothly. The municipalities, the RRGS, the provinces, the water management sector, the fire department and the first aid organizations combined and incorporated their data and data systems very successfully. The cooperation between the different organizations did not demonstrate any significant problems that hindered, delayed or altered implementation of the Riskmap. The only dissatisfaction lies in the professional corner, where there has been a lot of attention for the public Riskmap, the professional risk map has been neglected to a certain degree. First aid and medical professionals as well as the fire department have been very disappointed about this but they do believe, and are promised, that as soon as the public map is operational and in the air all the attention will be driven to further professionalize the professional map.

Along the process the Riskmap is not supposed to only serve as an inventory and a means of communication, an extra goal is added namely the goal of transparency and accountability. Through the Riskmap the local governments' plans for spatial planning, extra safety measures, reconstruction of roads and so further, must become more transparent. This was originally not the prime idea of the Riskmap. Furthermore the Riskmap is supposed to make sure that citizens can hold their municipal government more accountable for the risks in their surroundings. Now also the permits of companies, storage of substances but also of public buildings are mentioned on the site. Citizens can see whether governments make sure they adequately monitor these permits and if they are renewed in time. The local government is in this way made accountable for its own permit policy. Originally the permits were not placed on the Riskmap but later on, for the sake of transparency and accountability they were.

Additionally in the process of implementation the national government decided the Riskmap should also hold a preventive function. Through the Riskmap citizens would become more aware of the risks in their neighborhood and the Riskmap should also give adequate information on what to do if something did happen, for each risk a sort of a plan. This would take form in telling citizen when to go inside, when to evacuate and so further. This plan is not included in the Riskmap as of yet and it is unsure whether it will.

8.2.3 The Outcome of the Process of Implementation

When looking at the outcome of the process of implementing the Riskmap several issues come forward. First of all the goals of the Riskmap were reached fairly successful.

The Riskmap is very successful in making policy on potentially dangerous substances more transparent. According to documentation as well as respondents, both government and citizens agree with the way these substances are placed on the map. Also first aid professionals and fire departments are very pleased with an oversight of the places where potentially dangerous substances are placed. Transparency in this way has increased.

Secondly, even though this was not originally one of the goals of the Riskmap, through the obligation of municipalities of putting all potentially dangerous situations on the map they can be held accountable for the safety of these places. Now they have to make sure permits are renewed in time but also in terms of spatial planning they are held accountable that there will not be built any homes in unsafe places.

Furthermore the cooperation between different organizations such as the fire department, medical professionals, professionals from RRGS, water management professionals and the municipality, the provinces and the technicians of Geodan turned out to be a success. A power struggle was expected at first, this turned out not to be the case. All organizations agreed on the goals of the Riskmap and were willing to put their effort into making sure these goals were reached.

This brings us to a third success factor, namely the integration of databases. The municipality is responsible for coughing up the data to give to the provinces so they are able to put them in the Riskmap. But there are other data which had to be placed in the Riskmap as well. Over the years an enormous amount of datasets were built on dangerous situations. The RRGS owned one, municipalities owned a few. While permits were often not linked to storage of substances, the fire departments owned one, medical professionals and first aid professionals also owned a few and the water management sector owned one too. All these different databases had to be integrated into one big database. In the past this has shown to be very difficult, in the case of the Riskmap there seem to have been no problems at all and the integration of the different databases moved smoothly.

On the side of the citizens there are some problems, regardless of the report made which stated that citizens were unable to work with the Riskmap because they were unable to locate their town, there was another problem. According to respondents citizens simply seem not to be interested in the Riskmap. The site of the Riskmap is not frequently visited and most people never visit it at all. They claim they have never asked for something like a Riskmap and some people even claim the Riskmap makes them feel nervous and unsafe. Also there are a lot of people unaware of the Riskmap. The national government planned to launch a campaign to promote the Riskmap and make people aware of what they could do with the Riskmap. The effect of the campaign was barely visible. This means the goals of more awareness for potential risks on the side of citizens is not reached. While citizens do not often visit the Riskmap, feel uncomfortable with it or are not aware of its existence, the awareness the government aimed for is not reached. Linked to this is that the preventive goal of the Riskmap, letting people know what they should do in case of an incident is not reached as well.

Another point that did not prove its success yet is the professional map. There is a professional Riskmap at the moment which is operational. However professionals feel that it should be further developed, with more information and the information that is given should be more detailed. They feel that too much attention is given to the public Riskmap and that the professional Riskmap is neglected. Here it must be noted the professionals claiming this do believe that the professional Riskmap will be further developed. This is also promised by the national government as well as the provinces.

Although we can see that cooperation between all relevant parties moved in a smooth matter and the sharing and integrating of databases did not prove to be a problem we do see that the police departments did not join in on the Riskmap. They did share their relevant information for the database for the Riskmap but they do not use the Riskmap, and do not intend to in the future. They acknowledge the usefulness of the Riskmap for other professionals and for citizens and they acknowledge in case of large disasters that the Riskmap can be very helpful. For their cause however they claim the Riskmap is not very useful to them, they remain using their own information system.

Furthermore we see that with the problem around the affect-distances and the involvement of international corporations and the Ministry of Economic Affairs that there is a serious fear of some for the use of the Riskmap by terrorists. This fear still exists although most Dutch authorities regard this as overrated, because a terrorist would be able to obtain this information anyway regardless of the existence of the Riskmap. Additionally the affects-distances are very unreliable to begin with. Wind and other natural circumstances are difficult to predict and therefore the measurement of the affect-distances are a guess at best. The fear of municipalities that citizens will complain and cause problems on the storage of dangerous substances does remain in place. While the national government aims for transparency the municipalities fear that this transparency will cause citizens to be alarmed and demand for the municipalities to move the substances elsewhere. Although this fear does continue, there has been no incident in which citizens actually complained.

With the actual use of the Riskmap there are some interesting points. First of all, the existence of the Riskmap has a severe impact on spatial planning on the side of the municipalities. In building plans municipalities take the storage of dangerous substances and potentially dangerous factories into account. When there are several locations of storage located closely to one another, the municipality decides not to build homes there. Before the existence of the Riskmap the information on dangerous substances and other potential risks was so dispersed the local government did not have a clear oversight on where these risks were geographically located. Because of the Riskmap this oversight does now exist and weighs heavily in decision-making on urban planning.

In the field of accountability there are some interesting points as well. Since all permits are listed on the Riskmap and while these permits and their expiration date are visible for the public, the local government can be held accountable for making sure that their policy on permits is executed according the rules. Where before permits sometimes expired and the local government did not inspect the location again, now local governments cannot do this anymore. Not only citizens can complain about this, as happened in the Dutch city of Eindhoven, where citizens were upset that a sight in their surrounding had not been inspected in time, also the provinces are looking over the shoulders of the municipalities. Local governments admit that this puts pressure on executing the permit policy very accurately, since they anticipate citizens to complain.

Linked to this in the process of developing the Riskmap, local governments as well as provinces noticed there were incidents in which the rules were not properly executed. They feared when this would be visible on the Riskmap they would be held accountable for this. Therefore in the process of implementing the Riskmap several changes were made so these incidents were solved before they were placed on the Riskmap. This was the case for the gas stations LPG, they were located too close to homes in urban areas, prior to the Riskmap nobody seemed to have noticed this. Quickly there was a plan made to solve this issue before the gas stations had to be visible on the Riskmap. Here we see that because of the sheer existence of the Riskmap rules are executed more accurately because policy-makers fear they will be held accountable if everybody can see that the rules are not applied correctly.

8.3 GEOGRAPHICAL INFORMATION SYSTEMS IN THE RISKMAP

After explaining what the Riskmap is and how the process of implementation has developed it is time to look at what the meaning of GIS is in this application. The enhancing qualities and effects of GIS as described in chapter 2 will be looked at.

When looking at the qualities GIS are said to have and linking this to the Riskmap first of all integration can be found (Bekkers & Moody, 2006; Lips et al., 2000, Bekkers et al. 2005; Hout & Bekkers, 1998; Greene, 2000). The Riskmap is completely GIS based, therefore integration found in this case can be attributed to GIS. This integration is twofold; first of all linking of different datasets took place. Before the Riskmap was implemented several organizations owned different sets of data. The RRGS held the information on dangerous substances, the provinces the information of gas stations, the municipalities on permits and fire departments on a number of other issues. Now all this information is put into one dataset and in this way the information is not only complete but new information can be generated. For example, when municipalities were not aware of several dangerous substances stored in one area, they could have decided to build homes there, or a factory with a high explosive danger. Now with all the information present this decision can be made differently.

Integration also occurred on a second level, namely the level of standardization. Before the implementation of the Riskmap every organization worked with their own system of inventorying and communicating risks. Now they all, except for the police departments, work with the same application. Risk communication and risk inventory now has become standardized. Together with the linking of datasets this sometimes proves to be a problem while organizations feel like they are losing autonomy. This is not the case in the Riskmap, even without the police departments this was not a matter of autonomy but of the content of the Riskmap.

A second quality which GIS is said to hold and can be found in the case of the Riskmap is visualization (Bekkers et al., 2005; Hamilton, 1996; Greene, 2000). While the Riskmap, being a GIS, is able to visualize the potential dangers in such a way that citizens as well as professionals have a clear oversight of the surrounding. This has an advantage over any other way of making this clear. One respondent said: 'a map says more than a thousand words', this becomes very apparent in the case of the Riskmap. Risk communication in such a clear way would not have been possible in another way. Even though images are not moving the site still is able to demonstrate a large area and in this way an oversight can be given.

Next to qualities GIS are also said to have some effects, as described in chapter 2. One of these effects present in the Riskmap case is the effect of improved communication (Bekkers et al. 2005; Bekkers & Moody, 2006; Haque, 1996). In the Riskmap this is very apparent. The way the risks and potential dangers are displayed for all citizens to look at from their computer at home at any time does improve risk communication. The government is now able to communicate potentially dangerous situations to citizens in a comprehensible way. Before citizens, if they would want to learn about risks in their environment, would have to go to the city hall and would have to request information on specific topics. Now citizens are able to have an overview on their computer at home. For professionals the same goes, where they before only had their own application for potential risks now they are provided with information of other agencies. This does not cover the entire potential for communication, for example on the Riskmap one could establish a forum on which citizens could ask questions. Still risk communication through the sheer existence of GIS became a lot easier.

A second effect which can be found in the Riskmap case is increased transparency (Bekkers et al. 2005; Carver et al., 2000; Moukomia, 2004; Overchuk, 2004). Not only for citizens but also for professionals the risks and potential dangers in a certain surrounding become very clear. Before this information was dispersed and located at different agencies. Now there is a clear view of what is actually going on in a certain surrounding. The risks are well-defined and easy to find from ones own home. Citizens do not have to go to the city hall anymore and search through piles of incomplete information; first aid professionals do not have to call a number of agencies anymore to find out whether in case of disaster a domino effect could occur. Furthermore, governments themselves have a better overview of the information. Linked to this increase in transparency there is something else that should be noticed: accountability. For citizens but also for other layers of government the potential dangers in a municipality become very transparent. Also it is shown whether the municipality took the proper measures to renew permits. Therefore citizens and other layers of government can hold the municipality accountable for this. For this reason municipalities are more aware of their duty on taking care of the permits and making sure the information on the Riskmap is correct. Where they before were not really controlled they are now and they are also held accountable for this. This was not expected when the Riskmap was initiated but this is a clear consequence of the increased transparency in risk communication.

8.4 THE RISKMAP AND AGENDA-SETTING

Above is demonstrated how the use of GIS can enhance processes of agenda-setting in the Riskmap case. Now is the time to move on in applying the conceptual framework of agenda-setting to the case, in order to generate an understanding of how GIS influences the process of agenda-setting. First the building blocks of this framework, the variables taken out of the existing models, constituting the conceptual framework of agenda-setting must be addressed. After that the conceptual framework itself will be used to analyze the case of the Riskmap.

8.4.1 Concepts of Agenda-Setting

First of all the concept and variables making up the conceptual framework of agenda-setting will be addressed. This has to be done in order to provide for a proper understanding of how these variables are filled in the Riskmap case. First of all mobilization of bias will be looked at, secondly conflict of values, thirdly power, fourthly the formal institutional features, fifthly the nature of the issue and finally the policy window.

Mobilization of Bias

The first core concept in the conceptual framework of agenda setting is mobilization of bias, described in chapter 4 as the way some interests are organized into politics and others are organized out. Or in other words, how some issues obtain attention over others. This is the way dominant values operate in the favor of some and to the disadvantage of others (Bachrach & Baratz, 1970; Cobb & Elder 1972; Douglas & Wildavsky 1982;

Schattschneider, 1960). In the case of the Riskmap this is very difficult to find. At first municipalities were afraid the Riskmap would give citizens the power to complain about any potentially dangerous issue. This turned out not to be the case. In fact the Riskmap does give citizens this kind of power, while risks are communicated more clearly. However, according to respondents and number of site visits, citizens simply seem to be uninterested and therefore do not act upon this. While mobilization of bias in theory is very much present in the case of the Riskmap in practice it is not to be found in the relationship between citizens and government. Citizens seem to be uninterested in mobilizing for the sake of potential dangers in their surroundings and therefore do not. Where one could expect citizens to complain when their house would be built in an environment with a large number of dangerous substances, this does not happen.

For professionals and different layers of government the same can be found. In terms of mobilization of bias there is little to uncover. Few instances in which professionals pressed government to change something in the situation of storage of dangerous substances can be found but these are rare.

The case of the Riskmap itself does not seem to serve to the advantage of one group and consequently to the disadvantage of another group. This might be caused by the fact that the Riskmap itself is not an application with a very innovative character. It does not enable groups to do things they could not do before. The application just makes the things citizens and organizations do a lot easier.

Conflict of Values

The second core concept in the conceptual framework of agenda-setting which should be looked at is conflicts of values (Bachrach & Baratz, 1970; Kingdon, 1995; Sabatier, 1993). In the case of the Riskmap, clear conflicts are difficult to find. Everybody seems to agree from the beginning onwards on what the Riskmap should be, what it should entail and what the content should be. The government had to balance some between keeping the Riskmap accessible to many and to make it complete. If all information on all risks would be added the Riskmap would be difficult to understand for non-professionals. All parties agreed that this balancing worked out perfectly.

There was some conflict dealing with safety. Firstly there was the debate on the affect-distances. The provinces and the municipalities felt very strongly these should be visible. It turned out that they would not be on the public map. This was the only difference of opinion to be found in the Riskmap. Secondly, in the beginning, while all parties agreed on the idea the Riskmap should be made, there was some fear that terrorists would use the information provided for by the Riskmap. This fear was quickly laid off when everybody realized that terrorists could find this information anyway; it had always been open to the public.

The prime conflict in values can be found in terms of public awareness. Where all organizations consider risk communication and risk management very important the public seems not to be interested. They seem to trust the government to take care of risks in an appropriate manner.

Power

The third concept in the conceptual framework, perceived power relations, can be linked to the conflicts in values (Bachrach & Baratz, 1970; Sabatier, 1993; Dahl, 1961). Here power can be looked at in terms of struggles, in this way explaining the relationships between different actors and who of them is more able to set the agenda.

In the case of the Riskmap there is little movement of power from one organization to another. There are a number of instances in which the Riskmap gives an organization or a group of citizens increased power but it is not used.

First of all through the usage of the Riskmap citizens are given a larger deal of power. They formerly were able to see all the information that is now on the Riskmap but they would have to go to the city hall and would have to obtain information from different organizations. They would not have the oversight they have now and the potential dangers would not be linked to permits. Citizens with this information do now have the power to complain about dangerous situations, to mobilize against decisions their government makes in terms of internal risks, but they do not. Even though through the Riskmap they have a better position for getting their issue on the agenda, they are just not interested and choose not to make use of this position.

Additionally it can be noted that the Riskmap can make sure that citizens as well as other layers of government can hold the municipalities accountable for making sure regulations are applied properly. This also counts for the provinces. Again this does not occur, not only because citizens are uninterested but also because the layers of government are aware of this accountability. They make sure that before these risks are placed on the Riskmap the permit is correct. The governments already anticipate a reaction and therefore make sure that all the information is correct and done within legal boundaries. This can be demonstrated by the issue of the gas stations, the Riskmap showed they were located in the wrong place, before placing them on the Riskmap this issue was first resolved. What we see is even though citizens and other layers of government do not execute their newly found power it still has influence. Because of this power governments are more careful in checking permits and in dealing with risks properly because of their fear of being held accountable. So even though the power is not executed the threat that it could be serves its goal.

What is very important in terms of power and agenda-setting is because of the linking of different datasets and the way potential dangers in the Riskmap are visualized, agenda-setting within municipalities has changed. We see this especially in the sector of urban planning. Where this sector before already had all the information the oversight was never this clear. Now we see that with this information they gain the power of making sure some dangerous substances are stored elsewhere so they will not interfere with building plans. They can now choose to change building plans because building would be to close to locations with a potential risk. By linking all the different information, agenda-setting within government has changed. Before, in terms of power, only few parties knew where risks were located now everybody can see. This gives all the power to place their point on the agenda using the power the visualization of the Riskmap provides them with.

It must be said that the position of the first aid agencies has improved, because of the Riskmap they are more and more asked to join in negotiations regarding risk management. For them it must be noted that their power has increased, although, as well as other parties, they do not execute this power fiercely.

Formal Institutional Features

After dealing with the first three core concepts of the conceptual framework of agenda-setting the fourth concept, on the structure side must be dealt with. These are the formal institutional features (Bachrach & Baratz, 1970; Sabatier, 1993). For the formal institutions it can be said that they do not hinder but actually help agenda-setting in the case of the Riskmap. The Riskmap itself and its content is very clearly defined by law and regulations. There is little possible on the legal side of the Riskmap in terms of agenda-setting.

Organizationally, because in the Riskmap all the information comes together, all parties in agenda-setting procedures gained power just by the sheer existence of the Riskmap. They can now demonstrate why something should be stored elsewhere, why building plans should be changed, why a certain municipality cannot store a substance, and so further. On this point it becomes clear that even though the provinces coordinate the Riskmap, the municipalities have more knowledge of what is actually happening on their territory.

It has also become apparent that because of the new laws the municipalities now have a clear obligation to inform their citizens on potential dangers and risks. The Riskmap and its information is not just a service given to citizens, now it is their right to know. This would enable citizens to undertake action on risks in their environment. Because of this obligation it is also to be seen, from the side of other layers of government as well as from the side of citizens that municipalities as well as provinces can be held accountable for how they treat the risks on their territory. This could put issues on the agenda as well, as happened with the gas stations and the complaints of citizens on permits which were not renewed in time.

Nature of the Issue

The nature of the issue, as opposed to the content, is the fifth core concepts or building block in the conceptual framework of agenda-setting (Cobb & Elder, 1972). Where the content deals with what the case is actually about, the nature deals with five dimensions of the case by which expansion to a relevant public can be explained. It is then assumed that the more the issue will be able to expand the higher the chances for agenda-status are (Cobb & Elder, 1972).

When looking at the five dimensions of the nature of an issue it can be seen that in the first dimension, the dimension of concreteness versus abstractness, the Riskmap moves more to the side of concrete, while the issue is unambiguously and not very abstract. Therefore it should not expand easily. This is so because people are likely to find some of their own opinions back in a very abstract issue, in a concrete issue it becomes hard to find general opinions. Therefore people will not easily commit to an issue that is fairly concrete. On the second dimension, the dimension between general and specific, the issue moves more towards general. It is not very specific or peculiar which will make it expand more easily. People in a general issue are more likely to link their own opinion to the issue. Since the issue is very general it will affect a large group of people, where a specific issue will only reach a few people related to the topic. The issue, on the third dimension, enduring versus short-term, is very enduring and not a short term issue, this would make it more expandable. People will commit more easily to an issue that is in the long run; when an issue will only affect them in the short run people are less interested. On the fourth dimension, the dimension of the issue being simple or complex, the issue is fairly simple; the locations of the risks are clear and easy to understand for many. This simplicity increased because of the visualization function of the Riskmap. Before using the Riskmap this issue was very complex, information was dispersed and very technical. While complex issues do not expand quickly, the issue in the case of the Riskmap should expand easily. Finally on the dimension of routine issues versus extraordinary issues we see that risk management and risk communication has been an issue for years but that in recent times it gained attention. Therefore it will gain less attention than a new or extraordinary issue. An extraordinary issue will right away attract attention from a large group of people where a fairly routine issue does not.

Summarizing this it is to be seen the nature of the issue of risk management and communication should make it expand fairly easy, in practice we see that this is the case within government. In the public sphere, on the side of citizens, it does not expand, this

Table 8.1: The Riskmap on the Dimensions of Expansion

Dimension	Riskmap	Expansion
Abstract vs. Concrete	Concrete	Less likely to expand
General vs. Specific	General	More likely to expand
Enduring vs. Short-term	Enduring	More likely to expand
Complex vs. Simple	Simple	More likely to expand
Routine vs. Extraordinary	Routine	Less likely to expand

because people are simply not interested and rely on the government to make sure their environment is safe.

Policy Window

The final building block deals with the policy window. For the policy window (Kingdon, 1995; Cobb & Elder, 1972) it is very clear the Riskmap was pushed forward after the fireworks disaster in Enschede in 2000. At this point government and first aid agencies as well as citizens realized there was no proper way of knowing what kind of substances were actually in a certain environment. There was no way of knowing whether a domino effect would occur and information was far to dispersed to really know what was going on in the case of disaster. This was the clear start of the Riskmap; the report made after the disaster called for a way of informing citizens and of making sure all information was in place. This is when the Riskmap was born. All involved parties agree that without the disaster of Enschede the Riskmap would not have been made at this particular time. They do agree that it would be made eventually but without Enschede this might have taken a decade.

But this only explains the start of the Riskmap, when looking at whether a policy window can and does actually influence agenda-setting processes after the Riskmap was implemented, a clear yes can be found. The technology itself, the GIS in the Riskmap accounts for a policy window to open. Now it has become possible to actually list all dangerous substances in one map. This opens the opportunity of not only adding more data but also opens the possibility of starting discussions on risk communication, spatial planning and the giving out of permits. The existence and implementation of the Riskmap therefore accounts for the opening of a policy window in itself, giving people the opportunity to push their ideas forward by using the Riskmap.

Here it becomes clear that in terms of the variables, say the building blocks of the conceptual model, for mobilization of bias there is little to be found, the Riskmap does not really advantage one group over another. In terms of power it becomes clear that citizens gained power because now they have access to information they did not have before. This also comes forward in the sense that governments can be held more accountable for the risks in their territory. Furthermore it is seen that through the existence of the Riskmap a lot of power flowed to the field of urban planning, since all the correct information is now easily available. Large conflicts cannot be found. For the formal institutional features it is demonstrated that now the different risks are not as dispersed anymore this could help agenda-setting very much. The nature of the issue itself makes sure that the issue should expand fairly easy. The opening of a policy window at the time the Riskmap was initiated made sure the design process could start. There is an opening of a policy window as well at the time of implementation of the Riskmap; this gave citizens, governments and other organizations the opportunity to push ideas forward.

8.4.2 The Influence of the Riskmap on Agenda-Setting

After looking at the variables making up the conceptual framework of agenda-setting, the building blocks, and referring them to the Riskmap case we can now apply the conceptual framework of agenda-setting to the Riskmap case. As outlined in chapter 6 the conceptual framework of agenda-setting consists of three parts and four channels of interaction.

Starting of with the first part of the conceptual framework, the policy sub-system, (Sabatier, 1993) there are several parties to be distinguished. First of all there are the layers of government, the national government with the Ministry of Internal Affairs and the Ministry of Housing, Spatial Planning and the Environment, the provinces, the municipalities and the water sector. Secondly we see the crisis management professionals from LOCC, the RRGS, the fire departments, the policy departments, First Aid Professionals and GHOR, Geodan and the public. When placing these players into advocacy coalitions several coalitions can be distinguished. Firstly there is the national government, by which is meant the Ministry of Internal Affairs, Ministry of Housing, Spatial Planning and the Environment, the LOCC and the RRGS. These are together in one coalition because they operate as a group and press their ideas forward accordingly. Furthermore a second coalition exists of the provinces, being the prime caretaker of the Riskmap. The risk management sector is a third advocacy coalition while they have a large stake in the Riskmap. The municipalities form the fourth advocacy coalition while they are user as well as provider for data for the Riskmap. Furthermore there are the first aid agencies, the GHOR, and the fire and policy departments as the fifth coalition; they are placed in a coalition together because their goals are the same which lets them operate as a group. Geodan as the developer of the software forms the sixth coalition. Finally the citizens can be seen as the seventh advocacy coalition.

We see that in the policy sub-system the different advocacy coalitions function within their technological frame. This technological frame is the set of expectations, assumptions and views on the technology. How groups perceive this technology so to speak (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995; Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). In the Riskmap stabilization as well as closure on the meaning of technology has occurred, or put differently, has been present all along. This means that all groups hold the same technological frame on the Riskmap. Stabilization occurred because within all groups everybody seems to agree on what the Riskmap should entail and what it actually is, and closure because there seems to exist agreement between all different groups. Closure on the meaning of technology in this case holds that all parties agree the Riskmap is a mean to communicate risk and to give a proper and transparent overview of risks in the Netherlands.

Furthermore all the actors in the policy sub-system use their relative power to gain agenda status for their issue (Bachrach & Baratz, 1970; Cobb & Elder, 1972). It was mentioned the position of the first aid agencies has improved and they now have more power to make an issue move over to an agenda point. It was also mentioned that citizens have more power in pushing an issue towards agenda status, because they have more and better accessible information. Additionally on the one hand the municipalities lost power to the provinces and the citizens, while they can be held accountable for their risk management policy. On the other hand they gained power over the national government because now they are more aware on what is happening on their territory. This also counts for the provinces by the same reasoning. Geodan does not seem to have gained any power in the agenda-setting. The main conflict lies between the values of citizens; they are not interested at all in the Riskmap while all other coalitions believe risk communication to citizens is very important.

Summarizing this it can be said the public in this really holds a large deal of power, as perceived by all actors, even though they do not execute this. We see municipalities and provinces gain power, they loose it on another side again. There is no clear power struggle visible in the Riskmap case and extreme shifts in power are also not to be found. All coalitions in the policy sub-system seem to more or less agree with one another on major lines.

The second part of the conceptual framework of agenda-setting deals with the characteristics of the technology, not only what this technology can technically do but more important, how it is perceived.

So how is the technology of the Riskmap, the GIS perceived by its users and makers. Here a surprising consensus between all organizations can be found. Everybody seems to agree that the Riskmap is a mean of communicating risks and of making these risks transparent and clear to all involved parties. There has been no discussion from the beginning onwards on what the Riskmap should be, closure on the meaning of the Riskmap has occurred right away without any arguing.

The third part of the conceptual framework of agenda-setting deals with structure, this influences the policy sub-system. It is assumed that the actions in the policy sub-system are influenced by three factors. Firstly the formal institutions, (Bachrach & Baratz, 1970; Sabatier, 1993) these help citizens to push their ideas forward in making an agenda-point, these formal institutions also help provinces and municipalities to do so. So agenda-setting from either the side of citizens as well as the side of government is helped by the formal institutions. Secondly the nature of the issue influences the policy sub-system (Cobb & Elder, 1972). While the nature of the issue, as explained, would help the issue expand in theory, in practice this does not happen. It must be said that while the issue is simpler now, in the future this issue might expand very rapidly. Finally the policy window influences the sub-system. (Kingdon, 1994) The existence of the Riskmap accounts for the opening of the policy window, because of the now available technology and the simple overview, a window has opened through which citizens, organizations and governments can push their ideas forward.

Looking to the conceptual model as a whole we see four channels of interaction, first of all the channel moving from the structure to the policy sub-system. Here the structure mostly enables all parties pushing their ideas forward towards agenda-status. The formal institutions help the citizens, the municipalities and the provinces to do so. The nature of the issue makes sure the issue has the potential to expand fairly easy and quick. And a policy window is open for all to push their ideas forward, which however does not occur.

Secondly a channel of interaction moves from policy sub-system to technology. Here technology, thus the Riskmap, is made or shaped by the technological frames of the advocacy coalitions (Bijker, 1995, Orlikowski, 1992). There is no argument on what the Riskmap is, within the advocacy coalitions there is stabilization and between the advocacy coalitions there exists closure on the meaning of technology. Everybody agrees upon the idea the Riskmap is a mean for communication and providing for a transparent oversight for citizens as well as for professionals. It must be said the Riskmap by the municipalities is seen as a tool for giving the public power in this matter. Also it is seen by municipalities and provinces as a means for making them publicly accountable for their risk management strategies and their way of showing they have applied procedures properly.

Thirdly there is a channel of interaction from technology moving towards the policy sub-system. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the policy sub-system (Orlikowski, 1992). This means that once somebody has an opinion or a view of the technology he will act accordingly. Because all parties agree on the meaning of the Riskmap, after the shaping of the Riskmap nothing changes in the policy sub-system since there was consensus to begin with.

Finally there is the channel moving from technology towards structure. After the actors in the policy sub-system have shaped technology and closure on the meaning of technology occurs, the established technology will influence the structure. New rules and laws might be made and the technology will be embedded in the culture (Giddens, 1984). So the structure is a result of previous actions (Orlikowski, 1992). Expected is that as soon as the Riskmap gained some attention and as soon as it is completely operational the Riskmap will be used for prevention as well. It will be explained on the map what to do in cases of emergency, this will probably be laid down by law. Furthermore it is expected, and also feared by the municipalities, that we will see a culture in which citizens will actively be involved in the risks in their area. It is also expected that while first aid agencies get more and better access to negotiations especially in urban planning that this trend will set through. Finally it can be noted that the existence of the Riskmap does provide for the opening of a policy window, so issues can be pushed forward.

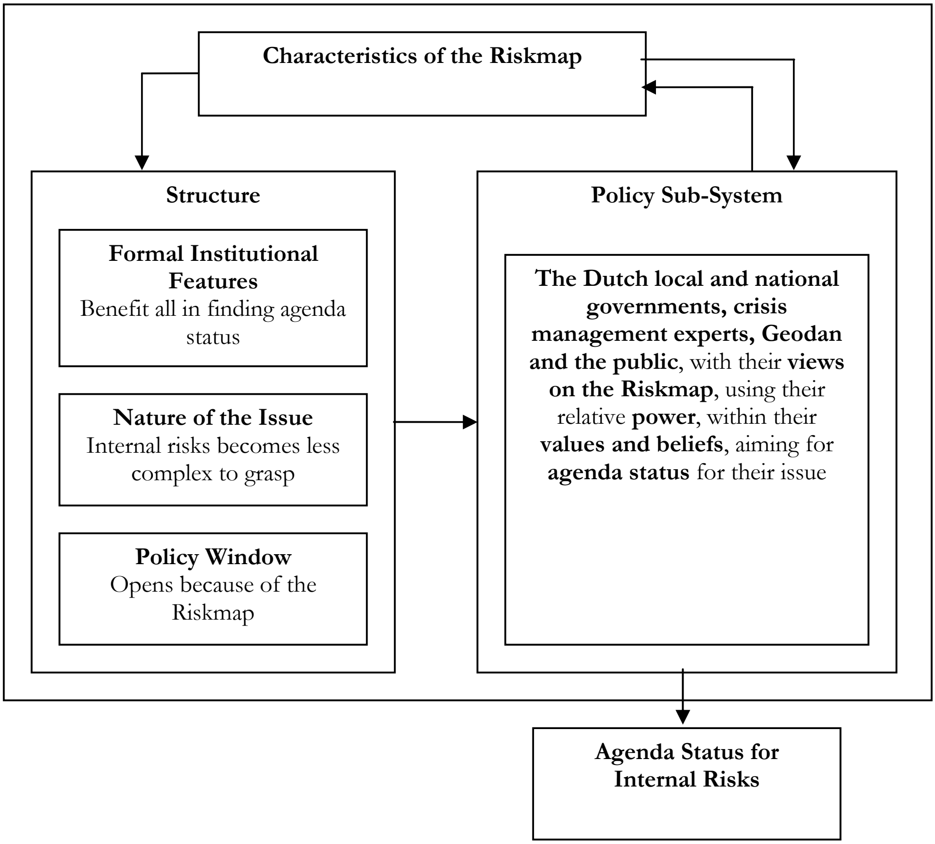

Figure 8.4: The Conceptual Framework of Agenda-Setting

8.5 THE SECOND ARENA, DESIGNING THE RISKMAP

As was the case for HIS and FLIWAS, in the case of the Riskmap a second arena has emerged as well. Next to the arena in which actors try to push or block ideas on risk management towards the agenda, a second arena has emerged in which policy has to be designed on the application of the Riskmap itself. These are issues dealing with access, content and use of the Riskmap. As before, in literature on policy arenas there is no theoretical background to be found on two intertwined arenas. Either they are regarded as separate and only mildly intertwined or they are regarded as one arena (Sabatier, 1993; Ostrom et al., 1994). Neither of these ideas are the case here. Therefore like for HIS and FLIWAS the second arena will be regarded as an arena which is intertwined with the first arena but the theoretical background can be found in literature on implementing information systems in organizations. Therefore issues dealing with autonomy, control and power relations become important (Markus, 1983; Goodhue et al., 1992). Below the second arena, in which policy is designed for the application of the Riskmap, will be discussed

8.5.1 The Riskmap and Policy Design

Before moving to the conceptual framework of policy design, like above, first the variables taken out of the existing models, the building blocks of the conceptual framework of policy design, will be discussed. First bounded rationality must be dealt with, secondly satisficing, thirdly conflicts of values, fourthly power, fifthly formal institutional features, sixthly rules in use and finally culture.

Bounded Rationality

Bounded rationality is the first important concept of the conceptual framework of policy design. Bounded rationality holds the idea that humans cannot act completely rational because they are not able to list all alternatives to a policy problem and are unable to predict every possible consequence (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968). This is clearly to be seen in the case of the Riskmap. In some instances the bounds of rationality have decreased but there are also instances in which they have increased.

The bounds of rationality where lifted on three occasions. Firstly a decrease in the bounds of rationality can be found on the side of the municipalities and the provinces. Before they were unaware of which risks were located on their territory. Now they are clear on what kind of risks there are and where they are located. Before this information was very dispersed between agencies, every organization held their own, incomplete, list of risks. Additionally there was no clear overview of where these risks were located, now while making and using the Riskmap this is not the case anymore. This influenced decisions on urban planning, municipalities can decide not to locate homes in a certain area because they now can predict the potential consequences in case of disaster.

A second decrease in bounds of rationality can be found on the side of the first aid agencies and for the national government. Where they were very unaware of existing risks, now they have a clear idea of what the risks in their environment are. This gives them the opportunity in case of disaster to make quicker and more informed decisions. For first aid agencies this means that they know whether a domino effect will occur and if so what to expect, the bounds in rationality in this field clearly diminished.

For the public, thirdly, the bounds in rationality also decreased. After the disaster in Enschede the public was outraged that they were not aware of a fireworks factory located in their area and that they did not know what to do and what was happening. With the Riskmap citizens are able to see what kind of potential dangers are located around them and what could possibly happen. Citizens can now, because of the given information, make decisions in case of disaster but they can also complain and make themselves heard with a stronger backup than before. Risk management for them became a lot more transparent and this information lifted the bounds of rationality.

It must also be said that where the bounds of rationality were lifted on the matters mentioned above, there are instances in which the bounds of rationality have increased. This is threefold as well. Firstly this can be seen on the side of the municipalities. Municipalities had not dealt with this kind of risk communication towards citizens before, therefore municipalities were not sure what to expect from citizens. They feared that citizens would complain about every risk or potential danger. This did not happen and while in the implementation of the Riskmap the municipalities did not have the power to stop or alter the implementation. Because of this fear the bounds of rationality and the insecurity of municipalities remained.

A second occurrence where the bounds of rationality have increased is found in the accountability issues. Municipalities felt controlled by other layers of government as well as by citizens. Everybody could see when permits were due and everybody could see whether the municipality executed regulations properly. Even though this did not prove to be a problem municipalities were unsure about the consequences of this. The bounds of rationality clearly increased.

Finally the bounds of rationality in the beginning phase of the Riskmap increased on the subject of terrorism. Some feared that when all this information would be available on the internet for everybody to see from their own home, that terrorists would use this information. Whether terrorists would do so and how was a complete mystery to all parties, a clear rational decision on how to dissolve this could not be made. In the end all assumed that if terrorists would want to attack they would be able to do so anyway. In the terrorist matter we see that all layers of government were left in the dark on what they were up to, increasing the bounds of rationality.

Satisficing

The concept of satisficing instead of optimizing (March, 1994) stems from these bounds of rationality. When one is not able to list all alternatives to a problem, chances are that a perfect solution will not be found. Therefore a policy-maker will often settle for a solution which is just 'good enough'. This comes forward on several occasions in the case of the Riskmap.

First of all the national government had to balance between the completeness of the Riskmap and accessibility. When the map would be complete with for example all properties for all dangerous substances citizens would not be able to understand the map anymore. The government chose to make the map as accessible as possible and secondary to make it as complete as possible. The balance thus shifted to accessibility. The government had a difficult time compromising and chose for a satisficing solution simply because an optimal, in this dilemma, was not to be found.

Another instance of satisficing can be found in the battle between the professional Riskmap and the public Riskmap and the time and effort placed into them. First aid agencies and risk management professionals are very displeased there is very much time invested in the public Riskmap and that the professional Riskmap is fairly neglected and was not completed by March 2008. The national government has promised that after the launching of the complete public Riskmap all efforts will go towards the professional Riskmap. The first aid agencies and the risk management professionals had to settle.

Furthermore the provinces and the municipalities had to settle for a satisficing solution in the matter of the affect-distances. They wanted them to be on the public map as well the professional, the Ministry of Internal Affairs, pressured by the Ministry of Economic Affairs decided not to do so. The provinces tried through negotiations and letters to still have the affects-distances on the map but they failed. The IPO then settled for a satisficing solution.

Conflict of Values

The third core concept in the conceptual framework of policy design is conflicts of values (Etzioni, 1967). In the case of implementing the Riskmap more conflicts can be found than in the agenda-setting arena. It must be said that there were little conflicts and that the conflicts that did exist were not very large except for the conflict of affect-distances as described below.

First there was a conflict of priority of public safety versus public information. This conflict occurred between the parties wanting the professional Riskmap to be developed as a first priority and on the other hand the parties wanting the public Riskmap to have first priority. This conflict was settled by first making sure the public map would be ready in time and promising the professional Riskmap would get serious attention after that. In real terms this was not a conflict without end, by law the public Riskmap had first priority, there was a final date, March 2008, set for it, and for the professional map this was not the case. So even though some parties were very displeased about this there was no real way for them to shift the focus.

In the very beginning there was also some conflict on whether citizens really want to have this information. There were some parties, and they were very dispersed among groups who believed they would only cause fear for citizens and they would create a culture of fear. This was fairly quickly dismissed for two reasons. Firstly this was dismissed by the enormous outrage at the time from the people in Enschede. Secondly even if citizens did not want to know, the laws and regulations obligating government to develop the Riskmap were already there.

Also there were some conflicts, also in the initial stages of the development of the Riskmap on external safety. How to deal with potential terrorist threats now they could obtain this information in such an easy way? As described above this did not grow out to be a very difficult conflict and was resolved very easily. Again this conflict did not occur between groups but among groups.

Furthermore there was a conflict on autonomy between the municipalities and all other parties. The municipalities feared that by putting all the risks on the map to see for the public, the public would complain about everything. The municipalities were afraid this would limit their capacity to decide on spatial planning and they would have to devote all their time dealing with concerns of citizens. This proved not to be the case but at the time this was not acknowledged. In this conflict the municipalities just had to settle because the plan and all the rules and regulations concerning the Riskmap were already made. The municipalities did not have the power to make a point in this conflict and they just had to settle.

Finally the conflict on the affect-distances proved to be the largest conflict, and really the only conflict that actually posed a threat to the progression of the Riskmap. The conflict started of a conflict between safety and information but ended on being a conflict between economic interests and information. The value of informing citizens conflicted very hard with economic interests. While international businesses threatened to move their business elsewhere or not to consider the Netherlands when expanding abroad, the Ministry of Economic Affairs held the opinion that making affect-distances visible on the public map would pose a threat to the Dutch economic position. Therefore they pressured the Ministry of Internal Affairs to decide not to place these affect-distances on the map. The IPO, the individual provinces and the municipalities were very upset about this and felt the map would partially lose its significance. They felt they were not being taken seriously in making an effort to inform the public. After some serious debate, several letters and some more debate the Ministry of Economic Affairs had its way and the IPO had to settle for this.

Power

Power issues, linked to the conflict of values are the fourth building block of the conceptual framework of policy design (Etzioni, 1967; Dahl, 1961). Actors use their perceived power to push their solutions and ideas forward towards a policy design. In terms of power a number of issues can be found in the case of the Riskmap.

Firstly the municipalities in their fear that citizens would keep complaining about every single risk had no real power to do something about this. They lost power on their own territory in this matter.

Furthermore the first aid agencies and risk management professionals did not have any real power to make sure the professional Riskmap was developed earlier and that it would gain priority over the public Riskmap.

The technicians did not have any say in the design process of the application; they had to do what they were told and were not in the position to make adjustment or alterations. This also counts for citizens; No party has actually measures or asked whether citizens wanted a Riskmap and if so, how they would like to have this map.

All the instances mentioned above can be brought back to one simple point. The national government needed to do something quick after the disaster in Enschede. It received questions from citizens on why nobody seemed to know anything about the fireworks factory. The government just made the plans for the Riskmap. Little debate and negotiation went on between the national government and other parties before the law was literally laid down. Debate on headlines was not possible anymore and all other parties did not have the power to change anything.

It must be said that in the implementation of the Riskmap first aid agencies and risk management professionals did gain significant power. Where they were not asked to the negotiation table in the initial stage, later on they were asked on several occasions, they had a lot to say about the content of the Riskmap.

What is interesting is the power of a party who was originally not involved in the implementation of the Riskmap and of which nobody expected they would be involved, namely the international business corporations and with them the Ministry of Economic Affairs. The result of the conflict on the affect-distances demonstrates that in this matter they had a real advantage in terms of relative power over all other parties.

Formal Institutional Features

Moving towards the fifth core concept and looking at the structure side there are the formal institutional features (Ostrom et al., 1994). These are the official laws and regulations. In the case of the Riskmap and the implementation of the application these formal institutional features are very important.

This is clearly to be seen at the point of the law. The national government made regulations and laws very quickly on how the Riskmap should look. There was little room for debate and negotiations on headlines. This made the implementation of the Riskmap move very smoothly, room for discussion was simply absent.

However, the organizational structure of risks and risk communication made the implementation difficult. In the Netherlands before the Riskmap there were a large number of organizations which held information about risks and had a stake in the Riskmap. All these organizations had to be involved in implementing the Riskmap. All the data had to be standardized into one system. This did not prove to be a problem but it did slow the implementation of the Riskmap down.

Rules in Use

Next to the formal institutions the informal rules and codes of conduct are important. They can affect the process of policy design significantly (Ostrom et al., 1994; Stone, 1997). In the case of the Riskmap there are two rules in use of importance.

Firstly one of the rules in use in the implementation of the Riskmap was that the national government had laid down everything by law already and that little discussion was possible as described above.

Secondly, even though little discussion was possible, there would not have been a lot of discussion to begin with. All parties seemed to share a view on what risk communication with the Riskmap should entail. All noses were pointing in the same direction. A clear view on risk communication and risk management existed which was held by nearly all parties.

Culture

The final building block for the conceptual framework of policy design is culture (Ostrom et al., 1994). There are a few instances in which culture affected the implementation of the Riskmap in terms of policy.

Firstly in the implementation of the Riskmap there was a clear culture of the national government holding everything in own hands. They had laid everything down by law and discussion was not an option for other parties.

A culture in which all involved parties make efforts to make sure to inform the public on risks and potential dangers is present as well. All parties were serious in informing the public and making an effort to do so. Everybody seemed to agree it was the publics right to know and the Riskmap would make the public aware of the risks in its environment. Cooperation therefore moved smoothly.

In the municipalities a culture of risk aversion was present. They feared citizens would complain about every risk and they were not sure about the consequences of this. They were not able to predict whether this might happen and to what extent.

What is very interesting is that the public demonstrated a culture of lack of interest. According to respondents the public seemed not to be interested in the implementation nor in the outcome of the Riskmap. As said in the field of agenda-setting. The public does not seem to be interested in risk communication or in the Riskmap; they trust the government in making sure they are safe.

As demonstrated above it becomes clear the bounds of rationality have decreased on a number of occasions using the Riskmap. A decrease is found because of the easy way to visualize all the information in a transparent way. On the other hand bounds of rationality were not lifted at all, since the application is fairly new it is difficult for governments, especially local government to oversee the consequences of implementing such an application. For satisficing it is demonstrated that actors had to satisfy instead of optimize on three occasions. Firstly a sub-optimal solution was chosen in the matter of the affects-distances, secondly in the delay in implementation of the professional map and finally in terms of accessibility. Where conflict of values and power is concerned it becomes clear that risk management professionals and first aid agencies gained significantly in power but that they were not able to push their ideas on the implementation forward. Finally for the formal institutions, rules in use and culture we see that since all was laid down by law the formal institutions and the rules in use helped the implementation. There was no room for institutional struggle. In terms of culture it is seen that the government tried successfully to hold all in its own hands but that within local governments a culture of risk aversion prevailed.

8.5.2 The Influence of the Riskmap in Implementing

Now the core concepts of the conceptual framework of policy design have been filled in for the case of the Riskmap the conceptual framework itself can be addressed. By using the three parts of the conceptual framework and the four channels of interaction the case of the Riskmap can be analyzed.

When dealing with the conceptual model of policy design of the Riskmap we first need to deal with the first part: the action arena (Ostrom et al., 1994.). This is the space in which all involved parties interact. There are several groups of actors in the policy design process of the Riskmap. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995; Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They then use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

When looking at these different actors the same actors as in the agenda-setting arena can be found: the layers of government, the national government with the Ministry of Internal Affairs and the Ministry of Housing, Spatial Planning and the Environment, the provinces, the municipalities and the water sector. Secondly we see the crisis management professionals from LOCC, the RRGS, the fire departments, the police departments, first aid professionals and GHOR, and Geodan. The international business corporations are now added as well as the Ministry of Economic Affairs but the public is excluded in the field of policy design. When putting these into coalitions or groups the groups are made up differently than in the agenda-setting arena. First the national government, with the Ministry of Internal Affairs and the Ministry of Housing, Spatial Planning and the Environment form one group. The provinces another and the municipalities form another. The layers of government which in the agenda-setting field functioned as one coalition do not in the field of policy design. They had different interest as described in the conflict of values above. The crisis management professionals, the LOCC, the RRGS, the fire departments, first aid professionals and GHOR make up another coalition. Furthermore Geodan makes a group but the public is not represented in a group. The final coalition is the coalition of the international business corporations and the Ministry of Economic Affairs, while they in the beginning might not have agreed with one another in the final case of implementing the Riskmap they aimed for the same cause.

The second part of the conceptual framework of policy design deals with the characteristics of the technology, closure on the meaning of technology here had already occurred from the beginning. All actors, as in the agenda-setting arena, view the Riskmap the same way, as a tool for informing citizens, integrating all data and taking power away from the municipalities.

When looking at the action arena the interactions are influenced by three factors. This is the third part of the conceptual framework, the structure. Firstly we must deal with the formal institutional features (Ostrom et al., 1994). The formal institutions helped implementation of the Riskmap and they favored the national government while they laid down the law and thus had the power to set down the rules before other parties joined in. Furthermore while in headlines all groups agreed with one another, the formal institutions helped the entire implementation of the Riskmap. The rules in use do the exact same thing, (Ostrom et al., 1994) giving the national government more power but not complicating relations with other groups which aim for the same outcome. Finally the culture is important, (Ostrom et al., 1994) the culture is correspondent with the institutional features and the rules in use, except for the culture in the municipalities of fear, but since they had no real power to change this it did not complicate the matter.

After dealing with the three parts of the conceptual framework the channels of interaction can be looked at.

The first channel of interaction is the channel moving from structure to the action arena. The influence of this channel is described above.

Secondly there is the channel influencing the action arena by technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artefact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992). Here as in the case for agenda-setting closure on the meaning of technology had occurred right away. There existed some problems at the initial stages regarding the fear for terrorists, the willingness of the public to obtain the information and the issue around the affect-distances. These problems were dismissed in a very early stage. Only the municipalities feared citizens would use this as a tool of power but other parties disagreed. Here the Riskmap was shaped easily into being a tool for communication of risks to the public and for combining data for professionals.

This brings us to the third channel, the channel moving from technology back to the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992).While all parties in the action arena agreed to begin with on the meaning of the technology and thus on the meaning of the Riskmap this channel accounts for consensus within the action arena. What should be noticed is that there was disagreement between all parties and the international business corporations and the Ministry of Economic Affairs. They regarded the Riskmap as dangerous and other parties did not. This constrained actions in the action arena. Because of this shaping of the Riskmap the affect-distances were not placed on the public Riskmap this because obviously the Ministry of Economic Affairs held a larger amount of power compared to the Ministry of Internal Affairs in this matter. The entire conflict can be brought down to this channel.

Finally the channel from technology to structure exists. After the actors in the action arena have shaped technology and closure on the meaning of technology occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). This has happened clearly in the case of the Riskmap. Plans are being made to expand the Riskmap with advise to citizens on what they should do in case of disaster, and this would be institutionally laid down. The culture changes as well, with the introduction of the Riskmap municipalities as well as provinces are forced to make risk communication to the public a priority. The hope is the Riskmap will also make sure there will be more cooperation between the different first aid agencies since they have to work the Riskmap together.

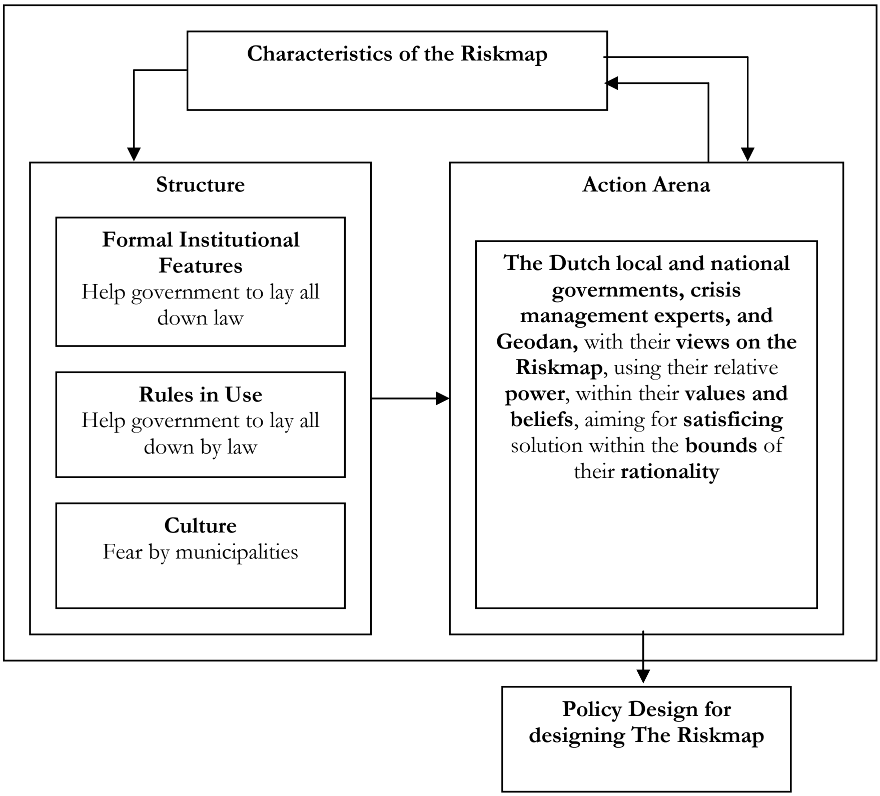

Figure 8.5: The Conceptual Framework of Policy Design

8.6 CONCLUSIONS

When coming back to the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?" First of all it must be concluded that when dealing with the influence GIS have next to the arena in which agenda-setting occurs simultaneously another arena rises on how to design and how to implement the GIS at stake. This has happened in the Riskmap case as well. Therefore we must deal with both arenas.

Starting of with agenda-setting an influence of GIS can be found when looking at the qualities and effects GIS are said to have. First of all it can be found that the Riskmap has an influence on agenda-setting by the different datasets which where linked with one another. In this way new information was made visible which was invisible before. This accounted for the clear overview the Riskmap provided for and also made sure that the dispersed nature of the information on risk management diminished. Domino effects were visible and decisions on spatial planning can now be made in a more elaborate manner.

Secondly all involved organizations except for the police departments now work with one application instead of their own application. This proves sometimes to pose some autonomy issues but in the case of the Riskmap everybody agreed they could serve their cause better with one application. Since the national government decided which application there was no debate on this and autonomy issues are not to be found.

Furthermore the visualization function of GIS added to this increased transparency by making the risks available in a map which is easier to understand for citizens and gives professionals information over an entire area. Also this enhances the communication function because information is easier to understand and communicate.

Additionally GIS added to improved communication. While using a GIS the Riskmap can very clearly communicate risks to the public. Therefore the public is more informed than they were before the use of the Riskmap because an oversight was unavailable and information was dispersed.

Finally the Riskmap made more transparency possible, risks for citizens became clearer but also for government and first aid agencies. A map says more than a thousand words so to say.

When looking at agenda-setting processes as a whole, there is more to say on the influence of the perception and use of GIS. GIS influences the interactions and the actions taken. This was set out with the conceptual framework of agenda-setting. First it must be noted that in the field of agenda-setting all relevant parties in the Riskmap already had established closure on the meaning of technology, this diminishes conflict to a very large degree. Closure on the meaning of technology existed because everybody agreed on what the Riskmap was and what it should be. The Riskmap was perceived as being a tool for communication and integration. This occurrence of closure on the meaning of technology may have two different causes. A first cause could be the Riskmap was already laid down by law, there was no room for discussion. A second cause could be that the Riskmap did not account for anything really innovative, the application is new but the information is not.

Secondly cooperation moved extremely smoothly between all parties, this can be partly traced back to the influence of GIS. While all datasets of all different parties were linked and there was one standardized application, groups had to cooperate or else the Riskmap would not have been in its place. The linking of the sets and the standardization would have been very difficult if one would not have used a GIS. This need to cooperate gives way to possibilities of agenda-setting.

Through the use of the Riskmap power relations in the agenda-setting sub-system have changed. In agenda-setting, because of the Riskmap citizens hold a large deal of power. They now have an application with which they can back up their issue in making an agenda-point. It must be noted that while the Riskmap gives citizens this power as of now they do not choose to execute it and seem uninterested in the Riskmap.

Additionally, linked to this new found power of citizens, citizens as well as other layers of government can hold the municipalities accountable for their policy on risk management as well as on their execution of regulations for permits. Where the municipality loses power here, citizens gain power.

On other points the municipalities gain power, they now are more aware of the risks on their territory and about where these different risks are located. They have a clearer view on how to make decisions on storage of dangerous substances and spatial planning. Because dangerous instances become so clear we see several occasions in which within government points were placed on the agenda, like in the case of the gas stations.

First aid agencies are now invited to the negotiation table more frequent, they gain power this way. Through the Riskmap they will be able to set the agenda and make their concern an agenda-point especially when operating as a group. As of now this has not yet happened but in the future it might.

Finally, the Riskmap came into existence through a policy window which opened right after the disaster in Enschede. However the existence of the map itself accounted for opening a window.

What is very interesting is that, next to the arena of agenda-setting another arena emerged, the arena in which has to be decided on how to use the Riskmap, the arena of the design process of the Riskmap. This arena, as well as the first arena is very important in understanding the influence of GIS on policy design and agenda-setting.

In this arena it is seen that the bounds of rationality were lifted for several groups. This can be all traced back to the use of GIS. Where before issues were very much dispersed now we see that all the different databases could be linked and that all the information is clear in the blink of an eye by using a map. It must also be said that the bounds of rationality have increased on some points. First of all since this kind of provision of information to citizens was new, municipalities had no idea what to expect, they were unclear on whether citizens would complain about every potentially dangerous situation. Furthermore in the beginning of the implementation of the Riskmap there existed some discussion on how to deal with terrorism. The government did not only have no idea on whether implementing the Riskmap would pose a risk itself in terms of terrorism but also they were very unclear on how other departments would react to this. Consequences in this matter were very unclear and could not be calculated or predicted in any way.

Furthermore when looking at satisficing, power and conflict of values, several issues have occurred. The largest conflict were the affect-distances where the Ministry of Internal Affairs and the Ministry of Economic Affairs clashed. The Ministry of Internal Affairs did not have the power to put these affect-distances on the public map and had to satisfy by only placing them on the professional map.

What can also be found is that the national government made sure to hold everything in own hands. Before implementing the Riskmap all the laws allowing for the Riskmap were laid down. Therefore discussion on how the Riskmap should look and how it should be implemented was impossible. This is a very clear case of the reinforcement thesis. The Riskmap gives citizens more power but because of the way it was implemented it serves the ones in power, i.e. the national government. Other parties had little say in the matter (Kraemer & King, 1986).

On the side of the technicians this is also found. Where some claim that through the use of technology technicians gain a large deal of power, in the case of the Riskmap this is not to be found (Winner, 1977). The technicians could only move within the already established law and where not able to do anything on their own since all was established already.

When looking at the structure side a number of things need to be mentioned in the policy design area. First of all on the structure side there is little conflict or debate possible. The national government simply laid down the law on the matter of the Riskmap and there was no debate possible. The formal institutions, the rules in use and this prevailing culture, therefore hindered all other parties to make their point and to have influence on the design process. This limited interaction in the action arena severely.

It must be said there would be little discussion anyway on what the Riskmap should be since there was a culture in almost all involved parties in which a shared view prevailed on how to deal with risk communication. Only on the side of the municipalities we see a culture of risk aversion, which was based on the bounds of rationality in predicting how citizens would react.

After looking at the conclusions in detail it is time to see what this really means for the influence of the perception and use of GIS in processes of agenda-setting. Five main conclusions can be drawn based on the case of the Riskmap.

Firstly it can be seen that GIS does make integration of datasets and standardization very easy. By using GIS the different datasets came together without much problems. This influenced agenda-setting processes since by integrating the data issues become visible.

A second conclusion which needs to be drawn is on the side of citizens. GIS made it possible for citizens to gain in power and to obtain detailed information on internal risks in an easy manner. However citizens do not execute this power. They seem completely uninterested. This shows us that the government can have a certain perception of GIS, this does however not mean the GIS application will actually be used according to this perception.

Thirdly in the Riskmap case it shows there existed a perception on GIS initially, namely that it would be used for communication. Later however accountability issues came into play. Because of the communication function of GIS citizens were now informed on risks and they could hold their municipality accountable. Municipalities anticipated on this and made sure all permits were correctly handled. This demonstrates that because of the expected effects of GIS governments can and will take measures in order to make sure the undesired expected effects do not take place.

A fourth conclusion deals with a culture of risk aversion and fear. Because consequences and effects of the new application could not be predicted a culture of risk aversion can be found on the side of municipalities. They feared the visualization function and communication function of GIS would cause for citizens complaining about every risk. This demonstrates that new applications, and therefore also GIS, can account for a culture in which fear prevails because consequences are unknown.

A final conclusion deals with the implementation of the Riskmap. Very little conflict can be found in the implementation of the Riskmap. A large factor explaining this is that the national government very quickly laid down the law. When this is done to such a degree conflict becomes impossible since there is no room to discuss or negotiate the content of an application. This demonstrates the actor implementing the GIS application holds most power over its content.

Chapter 9

Keeping Live Stock Alive

9.1 INTRODUCTION

In 2001 an outbreak of mouth and foot disease hit a large part of Europe; this resulted in trade restrictions, economical damage and financial problems. For example, in the United Kingdom the whole situation added up to a loss of 10 billion Euros. Not only did the outbreak cost a lot of money but it also demonstrated that a contagious live stock disease could damage a lot of areas additional to agriculture.

In Germany before 2001 the development of an application started, this application is called TSN (TierSeuchen Nachrichten, Animal Disease News). TSN made sure information on farms was up-to-date, information on wild life, but also it made sure calculations on buffer zones and restricted areas could be made. The application also accounts for a logbook in the case of an outbreak. The 2001 outbreak gave live stock diseases a large boost in terms of political attention and TSN was developed even further. TSN is largely based on a GIS. With this application issues on contagious live stock diseases could often through visualization and calculation reach agenda-status very quickly.

In this chapter the case of TSN will be looked at in order to understand the perceived influence of GIS on agenda-setting and policy design. This chapter forms the third of a series of six case studies which will bring us further in answering the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?". This case study, as well as the cases of HIS and FLIWAS and the Riskmap will initially deal with agenda-setting.

In order to do so first in section 9.2 it will be explained what TSN entails, how it was designed and implemented and what the outcome of these processes were. This is to ensure a proper understanding of the application is guaranteed. In section 9.3 TSN will be looked at for the influence of the qualities and effects of GIS on agenda-setting. This will be done by analyzing the applications for the enhancing qualities and effects described in chapter 2. Next in section 9.4 the perceived influence of GIS on agenda-setting will be looked at by using the conceptual framework of agenda-setting. First its building blocks will be looked at and finally the conceptual framework itself will be dealt with, as described in chapter 6. What the case of TSN will then show us is that next to an arena in which issues on contagious live stock are being pushed towards, or blocked from agenda-status a second arena emerges. In this arena contagious live stock diseases are not the subject of discussion but the application itself. In this arena policy has to be designed on how to program and implement TSN. This arena will be treated as an arena of policy design as described in chapter 6. First the building blocks of the conceptual framework of policy design will be dealt with and finally the conceptual framework as a whole. In the end a conclusion will be given with an overview of the perceived influence of GIS on agenda-setting and policy design in the case of TSN.

9.2 TIERSEUCHEN NACHRICHTEN

Contagious live stock diseases form a mayor risk not only for farm animals but also for animals living in the wild. An epidemic outbreak of a contagious disease could hit the agricultural sector hard and influence import and export severely. For example, the outbreak of mouth and foot disease in the United Kingdom in 2001 accounted for an economic disaster costing the government 10 billion Euros. In Germany, as in other countries, governments, and other organizations consider the prevention of large outbreaks of these diseases of prime importance. Therefore the German government has implemented an application to manage and prevent outbreaks.

In this section first the features of the application of TSN (TierSeuchen Nachrichten, Animal Disease News) will be explored in order to understand what the application is and can do. Next the process of implementation of TSN will be explained and finally the outcome of this process will be elaborated on.

9.2.1 Features of TSN

The application used in Germany for managing live stock diseases is called TSN (TierSeuchen Nachrichten, Animal Disease News). It has been developing since 1993. The core of the functionality of the application is threefold, first of all its goal is to establish a computerized, nationwide alarm and evaluation system to find and communicate outbreaks of infectious live stock diseases. With this information it can be established what should be done next and to evaluate later whether the correct action has been taken and what one could learn from an outbreak. Secondly TSN would function as a databank for research in the areas of contagious live stock diseases. The application is made as Client-Server architecture; this means there is one server containing all information and others can access some or all of this information. The server is built around a central database containing all live stock diseases and all related data (Zentrale Tierseuchendatenbank ZTSDB, Central Animal Disease Database). All people and organizations which are granted access to TSN can online, through an Internet browser, access this database and obtain the information they need. Additionally there is an intranet application which is primarily accessible for veterinarians; here they can find statistics and addresses from separate farms and legal provisions on these farms. This information is not public, since the privacy of farmers would be severely violated. Finally there is a map server integrating all the data and showing this in the form of a map.

The case is that for each outbreak it becomes clear where exactly the outbreak has occurred, on which time it was found and the history of the diagnosis. As well as the measures which should be taken to either cure the animals or to prevent spreading. This is done so follow ups on the measures can be taken and in the case of an epidemic others can see what

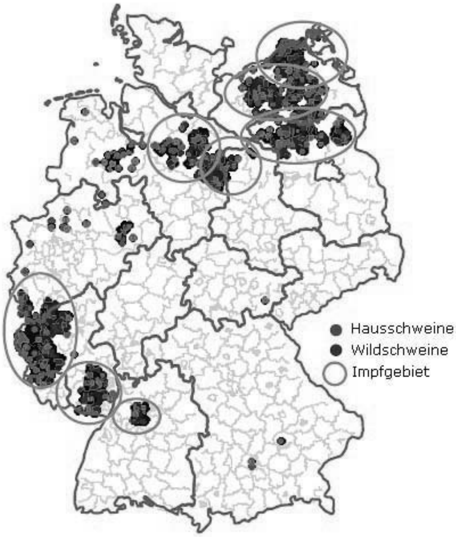

Figure 9.1: Areas to Vaccinate in Case of Swine Fever Outbreak (Bundesforschungsanstalt für Viruskrankheiten der Tiere)

exactly happened. Only a part of the application is based on a GIS, this is the part where the data are linked to a locality and calculations and predictions on spreading are made. These calculations can be of very high importance. All farms containing live stock are listed on maps and data on these farms can be requested when having a password.

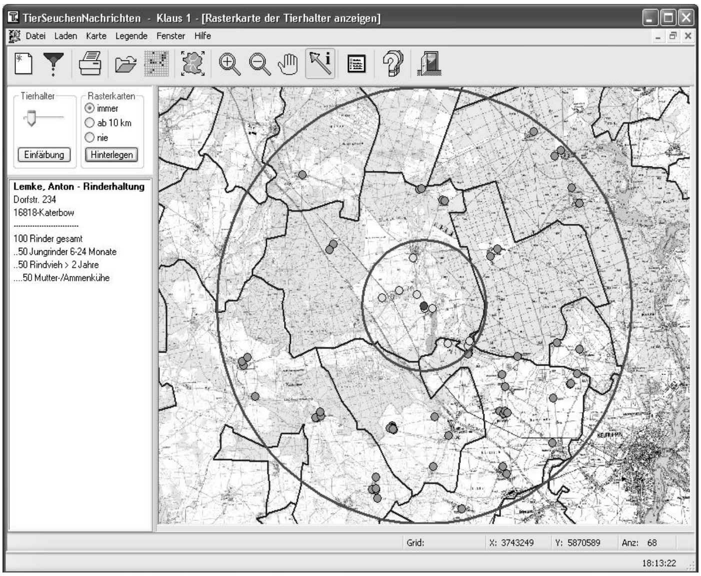

Figure 9.2: Potential Danger for Farms in the Neighborhood of Infected Farm (Bundesforschungsanstalt für Viruskrankheiten der Tiere)

In the case of an outbreak GIS will calculate how fast the disease would spread. The application will take different variables into account, like the presence of other farms in the neighborhood of the infected farm, presence and density of related and possibly infected animals living in the wild, mobility of people in the area, speed of the wind (in the case the disease is airborne) and so further. The application will be able to predict the speed but also the scope of the spread of the epidemic. With this information one could establish a restricted area, this is an area around the infected farm in which no animals can be transported and other measures like the cleaning of shoes or tiers can be required. Additionally a buffer zone will be created around the restricted zone which will have the same rules. GIS will calculate where this restricted area and this buffer zone should be located and how large they should be, taking in account natural borders, depending on the disease and the variables named above. Through simulation with different buffer zones it becomes clear which buffer zone to implement. In the case of an outbreak of a disease for which animals can be vaccinated the application will calculate in which area the animals need to be vaccinated first.

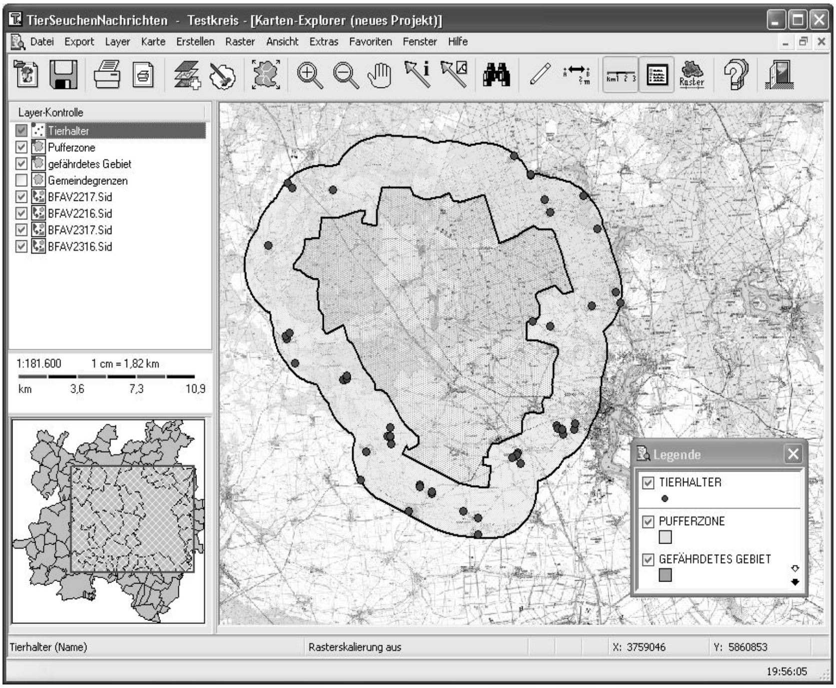

Figure 9.3: Potential Buffer Zone in Case of Outbreak (Bundesforschungsanstalt für Viruskrankheiten der Tiere)

TSN is also used in different crisis centers. In he case of an outbreak it is clearly to be seen on a map which measures are already taken, the application saves these in a logbook. The effects of future measures in terms of spreading of the disease can be predicted using the GIS component. In this way TSN becomes a tool for crisis management.

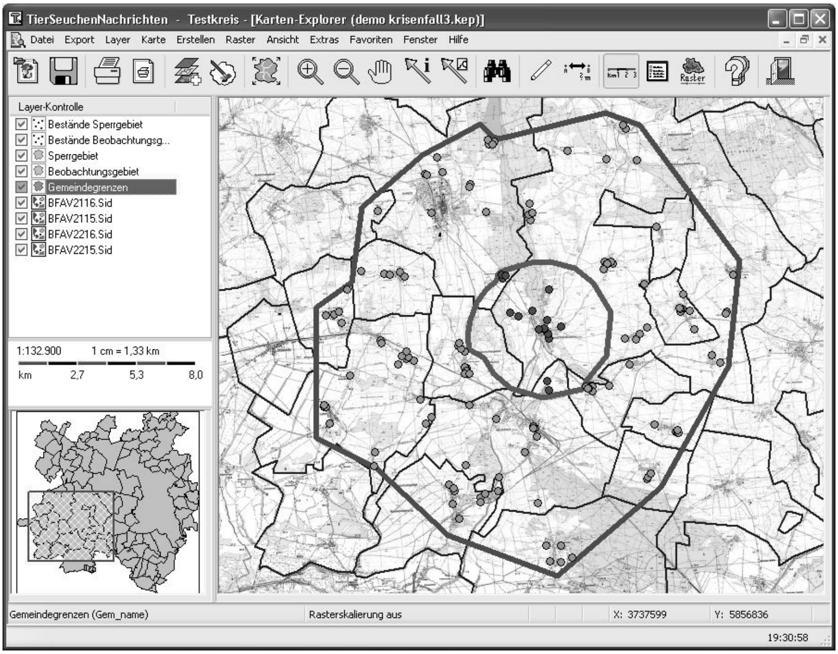

Figure 9.4: Restricted Area and Area at Risk in Case of Outbreak (Bundesforschungsanstalt für Viruskrankheiten der Tiere)

Important actors in the prevention and managing of outbreaks of infectious diseases are first of all the farmers. They have the obligation to notify the veterinarian appointed by the state when the farmer would suspect an animal suffers from a highly infectious disease. Secondly the veterinarians appointed by the German Federal State or of whom the state has confirmed their status (Beamte Tierärtze) are important. Most veterinarians, either appointed or not, are organized in an organization for veterinarians, this organization is organized per state (Tierärtzenkammern). They, as an organization, work with TSN and are also important stakeholders in the matter. Furthermore the Ministry for Nutrition, Agriculture and Consumer Protection (Ministerium für Ernährung, Landwirtschaft und Verbraucherschutz) has a say in the matter, this regards to the Federal Ministry as well for the Ministries of the states. Where in the case of an outbreak this is the responsibility of the states, in a later or more severe stage the federal Ministry moves in. If the outbreak is very severe and widespread and measures have to be taken that prohibit people in their daily mobility, the law allows the military to enforce these measures. Another important organization is the Friedrich Loeffler Institute; they function as the knowledge institute for infectious animal diseases and also run and operate TSN. In the case of an outbreak they establish the exact diagnose and communicate with the government on which measures to take to prevent further spreading. This could include restriction areas, buffer zones but also vaccination for which they supply the vaccine. Furthermore the Friedrich Loeffler Institute is responsible for supplying the press with information, but also the government, farmers, and veterinarians on a yearly basis in a report on the newest developments in contagious live stock diseases. The European Union is also an actor, by European law countries are obligated to have a system by which contagious live stock diseases are diagnosed and communicated. Countries are forced in the case of a suspected outbreak of a highly contagious disease to report this to the European Authority.

9.2.2 The Process of Implementation

When looking at the process of implementation of TSN the history of databases on contagious live stock diseases is important. In 1992 the European Union made plans to make sure outbreaks of animal diseases were communicated faster and were logged in a logbook, to ensure quick response to an outbreak. A project named ANIMO (ANImal MOvement) was launched. Each European country made sure to cooperate in the program. In Germany it was the Friedrich Loeffler Institute which dealt with this matter (at that time named the Bundesforschungsanstalt der Viruskrankheiten der Tiere, Federal Research Center for Virus Diseases of Animals). The Friedrich Loeffler Institute saw further possibilities and started the development of a more integrated and more enhanced program: TSN.

TSN has been developing since 1993. First a DOS version was made with which few people worked, in 1994 the application became nationwide but co-existed next to the already existing applications for controlling and managing contagious live stock diseases. It must be noted here there existed a number of applications doing so; there was a large variety in these applications. The goal was to make TSN one integrated, nationwide application. In 1995 the application became functional in use, since 1995 it was possible to make notion in the application of an outbreak of one of the epidemics in which notification is required. In 1997 this was expanded with the possibility of notification of non-epidemic live stock diseases. In December 2000 the DOS application was transformed into a Windows application, and this version was renewed in 2002 and again in 2007. It must be noted here that the step from voluntarily use of TSN to mandatory use of TSN moved very smoothly. This is not so because people were so willing or so pleased by the application but simply because this was required by law. The European outbreak of the highly contagious mouth and foot disease which had its peak in the United Kingdom also contributed to a speedy and smoothly manner of enhancing and integrating TSN. It became clear at that point that an outbreak of this magnitude could cripple not only the agricultural sector but also damage the national economy severely.

During the implementation of TSN several other laws affecting the scope of TSN were implemented simultaneously. In 2004 the World Organisation for Animal Health classified different diseases into an A-list and a B-list. The diseases on the A-list are those with a potential for fast international spread with large economic and health consequences that could influence trade severely, such as mouth and food disease and swine fever. In the case of a suspected infection the farmer with the veterinarian has the obligation to alarm national and European authorities. On the B-list those diseases are listed that could cause some damage but would not influence trade severely, the farmer and the veterinarian must report the infection but there is no need for alarm. In both cases, an infection in the A-list or in the B-list, farmers or veterinarians always have the obligation to prevent spreading in any way possible. In Germany the Tierseuchengesetz makes the law clear on what to do in the case of an outbreak. The law on following the rules is very strickt and not obliging could result in a large fine or a prison sentence up to five years.

By law measures can be taken in the case of an outbreak of an infectious disease, farmers are obliged to cooperate with these measures. These measures include quarantaining of animals, implementing restricted areas and buffer zones, mandatory vaccination of animals, the killing of potentially infected animals, rules regarding transport and desinfection. In the case of severe measures the military will be brought in to enforce these rules. Thus when TSN was implemented a large number of rules were implemented as well. At the same time several existing applications where brought together in TSN.

However, there were some questions and problems. First of all there was the question of whom should have access to TSN and further who should have access to which part of TSN. All information in TSN is password protected and in the process of implementation it became important to establish who could view which content. The decision was taken the organizations of veterinarians and especially the state appointed veterinarians could view all data. Other organizations cannot, this because of privacy laws relating to farmers and their farm. Relevant organizations in government also have a password to access TSN as well as the Friedrich Loeffler Institute. Some conflict has risen since universities and agencies related to consumer protection in terms of nutrition do not have access. The point is that TSN is the only base for accurate, up-to-date information, research cannot be done without access to TSN. Mosltly results out of TSN take three years to be published which makes them outdated. As a response the government claimed that they could not give these organization access due to privacy laws. The organizations without access replied that they were not interested in that part of TSN so they did not consider this a valid point. Furthermore they claimed TSN only wanted partners who shared the same view on animal health and that people who were critical of this view where simply denied access. They therefore claim that the reliability of TSN is rather compromised.

Another important point in the implementation of TSN are the amount of rules, national and European. According to almost all stakeholders there are too many, often contradicting, rules. This makes it impossible to quickly take measures in case of an outbreak, which was the original idea behind TSN. Next the question came up on how far to take

TSN. Some organizations, specifically organizations dealing with consumer protection would like to see this chain also incorporated into TSN, while animal diseases can also cause human illnesses like salmonella or mad cow disease. Other organizations, primarily veterinarians, believe TSN should stay at its original aim to make sure the application does not become to political or to complex, and must thus only deal with animal diseases, their outbreak, prevention and containment.

9.2.3 The Outcome of the Process of Implementation

Now TSN is implemented a few issues of importance can be noticed. Firstly consumer protection is not in the application and the link from animal health to human nutrition is not made. TSN is still developing and in the future other sorts of data and calculations might be integrated in the application.

Secondly in the original goal of the application, making sure all organizations work with the same application, TSN is a large success. Other applications for prevention and containment of contagious live stock diseases are not in use anymore and relevant organizations, provided they have access to TSN are satisfied with the results. Especially in terms of speed, TSN provides for almost real time accuracy and the logbook module of what happened in the case of a suspected outbreak is perceived as very helpful.

Thirdly the matter of access is important, the conflict on who has access is still an ongoing conflict. Universities and other research institutes still do not have access and still are outraged about this. The official reason for this is still farmer privacy. Those without access claim they are not able to do any research without accurate information. Also they claim only those who already held the same views on live stock diseases as incorporated in TSN, have access to data. They are the only ones able to do research and critical notes are not possible. The organizations without access question the scientific reliability of the outcomes of the calculations made.

Others question the reliability and trustworthiness of the application as well. First of all the farmers fear that with an application like TSN in which different scenarios can be made, the government will impose even more rules and regulations on farming. This would make it very difficult for farmers. They feel attacked in the integrity of their farm and believe they can decide for themselves what should happen on their farm. More regulations from government are not welcomed. Additionally some veterinarians question the application; according to them it is important to realize that in any technical application the results from a calculation are purely dependent on how you place the data in the application. It could happen that decisions which are in essence political and should be decided on by elected officials now become the responsibility of the Friedrich Loeffler Institute. For example, in the case of an outbreak of a highly infectious disease a choice has to be made to prevent further spreading. In a zone, calculated by TSN all potentially infected animals should be vaccinated, quarantined or killed. This choice, according to some veterinarians is in essence a political choice, but one could use TSN to produce results of the three different scenarios. The insecurities of these scenarios are so high that somebody in favor of one of the options could insert the data in a way his preferred option would become the most effective option. This compromises the neutrality of TSN.

This demonstrates, as all stakeholders agree upon, that by the use of an application like TSN experts on animal health gain power in decision making over politics. Not only because they are the ones with the data and the results of prediction and scenario testing but also because TSN allows them by graphical images to communicate their ideas to policy-makers in an easy way. While animal health is very complex, communication by the use of a map makes it a lot easier for people with little knowledge of animal health to understand different scenarios and thus to choose between measures. Some stakeholders however, believe that the problem is made bigger than it actually is, the outbreak of infectious diseases is not frequent and when an outbreak occurs there are a number of measures to prevent spreading. They accuse policy-makers of forcing a problem forward to make sure the issue still gains attention and to make sure their position and the amount of money spent on animal diseases is secure.

In the outcome of the implementation process of TSN citizens are completely left out. This has several reasons; firstly according to respondents, citizens seem not to be very concerned about an outbreak of an infectious live stock disease. Only when the disease actually becomes an epidemic people become interested because measures may hinder them in their mobility. Secondly the regulations and laws, nationally and European on live stock diseases are so numerous and so complicated citizens are not able to understand what is really going on. The press does not seem willing to inform them on these highly complex matters. Consumers seem to be interested in protection and safety in nutrition but these matters are also hard to communicate due to the large margins of insecurities and would, according to experts, only cause for alarm and panic.

The question of how much to integrate into TSN also still remains, this is not an issue which divides groups of stakeholders but the question divides within groups of stakeholders. Still some believe the food chain and consumer protection should be included into TSN. Others believe TSN should stay the way it is to prevent further politicization of the application.

9.3 GEOGRAPHICAL INFORMATION SYSTEMS IN TSN

After looking at the features of TSN and the process and outcome of implementation it becomes important, before looking at agenda-setting, to lift GIS out of the application and to look at the qualities and effects GIS are said to have as described in chapter 2.

In this section the presence of these qualities and effects within the case of TSN will be elaborated on.

The first quality GIS is said to have is integration, (Bekkers & Moody, 2006; Lips et al., 2000, Bekkers et al. 2005; Hout & Bekkers, 1998; Greene, 2000) this can be found in the case of TSN in two ways. When firstly looking at standardization it can be found that in the case of TSN this quality is present clearly. In the case of TSN there is one application to deal with contagious live stock diseases where before there were many different applications. This does not only make sure that all involved organizations now work with the same application but also the work process itself became standardized. Every action or input of information by one organization can be viewed, real time, by any other organization. In this way a standard way of dealing with outbreaks has been realized. Before there were legal rules how to deal with an outbreak but there was no law on documenting al the actions. Now with TSN the application only allows one way of documenting measures and data, so everybody has to do this in the same way.

Secondly integration can be found in the field of integrating different datasets, making sure new information becomes visible by combining these datasets. The data on farms are incorporated with the data on live stock, animals in wild, nature in the area, natural and legal boundaries, and information on the diseases themselves. By combining all this data new information can be seen. It then becomes clear how all these variables relate to one another and in the case of an outbreak measures can be taken in line with the newly visible information. Regarding TSN there are voices to even expand the different variables and include more datasets, including consumer protection and nutrition.

A second quality GIS is said to have is calculation, (Bekkers et al. 2005; Bekkers & Moody, 2006; Moukomia, 2004) GIS are said to have a quality by which they are able to calculate large quantities of data and in this way sketch scenarios, consequences and interrelations. In the case of TSN it is clear that calculation has a large function. Because of the combining of the different datasets, scenarios can be tested and it becomes possible to calculate which measure will lead to the most desired effect, by simply trying out several measures in TSN. The calculations make possible to predict what would happen for example when a buffer zone would be located on one location instead of another.

The quality of visualization is the third quality GIS are said to have (Bekkers et al., 2005; Hamilton, 1996; Greene, 2000). This is the quality of making very complex data visible in a way the data is understandable for many actors, even for those without knowledge of the subject. In the case of TSN this can be found very clearly, the predictions and scenarios are outlined in the form of maps so everybody can see what is exactly meant by each measure. In TSN difficult calculations, formulas and graphs are substituted by maps and movies. Again here, a map says more than a thousand words. Through this quality of visualization it becomes clear to those actors who are not familiar with the field of contagious live stock diseases what has to be done in case of an outbreak.

Furthermore, GIS are said to have some effects, first of all the effect of improved and increased communication (Bekkers et al. 2005; Bekkers & Moody, 2006; Haque, 1996). This is very present in the TSN case, in a twofold manner. Firstly communication has become a lot easier. In the first instance communication between experts has improved, because now all parties involved work with the same application they know exactly what the other parties mean when communicating. A shared language exists and all information is up-to-date. Furthermore since all actions undertaken by an actor in the case of an outbreak are logged in a logbook for others to see this improves communication as well. Another way in which communication has improved which can be attributed to GIS is the communication between experts in the area of contagious live stock diseases and the government. Again like in other cases it becomes clear that very difficult information which was formerly communicated in graphs or tables, is now in maps, pictures and moving images. Through the quality of visualization, for politicians and policy-makers now it is clearer what is going on, what would happen during a potential outbreak and which measures should be taken.

Next to this improved communication there are also points where communication did not improve at all and was hindered by the use of TSN. This is mainly the case in the flows of communication between experts who have access to TSN and those who do not. Their language differs, and they are not able to talk about the same data. The actors with access to TSN have up- to-date data and the other actors do not. Therefore this communication is severely hindered. Communication towards citizens has neither improved nor deteriorated. In the area of contagious live stock diseases there are so many factors to take into account it becomes difficult to give the public the whole picture.

Finally it is said that GIS have the effect of increased transparency (Bekkers et al. 2005; Carver et al., 2000; Moukomia, 2004; Overchuk, 2004). In the case of TSN it becomes clear that transparency has increased on some points but has decreased on others. Transparency has increased firstly since all actors now work with the same application. Now it is clear to all what somebody else has done, which measures are taken, which information is available and so further. Furthermore the policy problem itself has become more transparent. Because of the integrated information and the possibility of GIS to sketch scenarios, the problem of preventing and containing outbreaks becomes more transparent. Several alternatives in the case of an outbreak can be looked at, a situation can be simulated in which a buffer zone is large or small, and the difference between restricting and vaccinating can be simulated. For government the transparency has increased as well. While contagious live stock diseases always were perceived as a very difficult subject, with lots of calculations, numbers and insecurities, now through visualization in the form of a map or movie it is easier for policy-makers to understand what actually is going on and what would happen in case of an outbreak.

On other instances transparency has not increased. Firstly this can be found in the matter of margins of insecurity. In calculations of potential scenarios the margins of insecurity are always high. This makes it difficult to ensure an accurate scenario, this diminishes transparency severely. This lack of transparency is not due to the use of GIS, these margins of insecurity exist regardless of the technology. GIS do have an impact on this, by presenting results in a movie or map it becomes difficult to communicate the margin of error. The movies and maps are presented as absolute, where in a calculation one could incorporate the margins of error. Another point where transparency has decreased is for those who do not have access to TSN, they have no way of gathering up-to-date information and have no idea what other actors have already taken in terms of measures.

9.4 TSN AND AGENDA-SETTING

The GIS component, as demonstrated above, in the TSN case had a profound impact on several instances which could enhance processes of agenda-setting. Now it is time to look at this process of agenda-setting in a more elaborate manner. In this section first the different concepts of agenda-setting, as lined out in chapter 6, will be elaborated on and secondly the influence of GIS in TSN on agenda-setting will be analyzed by using the conceptual framework of agenda-setting.

9.4.1 Concepts of Agenda-Setting

Before looking at the conceptual framework itself, first the concepts and variables making up the conceptual framework of agenda-setting will be looked at. This will be done in order to understand the impact of TSN on agenda-setting in the conceptual framework better. First of all mobilization of bias will be looked at, secondly conflict of values, thirdly power, fourthly the formal institutional features, fifthly the nature of the issue and finally the policy window.

Mobilization of Bias

The first important concept in the conceptual framework of agenda-setting is mobilization of bias. This is described as the idea that some issues gain attention over others. Some issues are organized into politics and others are organized out, by the way some values operate in favor of some and to the disadvantage of others (Bachrach & Baratz, 1970; Schattschneider, 1960; Cobb & Elder 1972; Douglas & Wildavsky 1982). In several instances this is clearly to be seen in the case of TSN. The most prominent instance is where some actors have access to TSN and other actors do not. The actors who claim they are not granted access to the up-to-date information and the calculation outcomes because they hold a different view on the prevention and containment of contagious live stock diseases. The actors who do have access claim otherwise, they argue that those who do not have access are not relevant actors in the field and by giving them access they would violate privacy laws of farmers.

Another instance where mobilization of bias clearly comes forward is in the debate how far TSN should be expanded. Where some believe TSN as application has expanded enough, others claim is should be expanded to consumer protection and nutrition. It is feared that when including consumer protection, TSN would become a political tool, not only for those involved but also for environmental organizations and organizations dealing with animal rights.

Finally mobilization of bias can be found in the application itself, the application is programmed so some solutions and measures are preferred above others. Since the margins of insecurity are very high in the calculations these margins of error can be used to make one outcome look better than another outcome. This is especially the case in the debate on vaccination of animals versus preventively killing them. Here it becomes clear that vaccination is organized into the application and killing the animals is organized out.

Conflict of Values

The second important concept in the conceptual framework of agenda-setting is conflict of values. This is important because in the conceptual framework it is assumed that all actors would like to see their idea on the agenda, therefore the outcome of conflict is partially determining whose ideas will gain agenda-status (Bachrach & Baratz, 1970; Kingdon, 1995; Sabatier, 1994).

In the case of TSN there are a number of conflicts in values to be found. Firstly the conflict on access, this holds the belief of some that others should be organized out of TSN, since they would not be relevant actors. The belief of those organized out is that they should be in. This causes for conflict.

A second point where values and beliefs are concerned is the scope of TSN. This is a matter of integration, how many databases and how many issues should be integrated. Or in other words: how far to expand TSN. Some believe that TSN should be expanded so it starts with animals on the farm and end in the grocery store. Others believe TSN should stay an application with the goal to prevent and contain outbreaks of contagious diseases.

Another value that is very important is the legitimacy of the application. Policy-makers and those who have access to TSN are convinced of the added value of the application and believe the application accounts for a rational way of dealing with live stock diseases. Others believe this not to be the case. They question the calculations which hold a large margin of error. They claim it can never be absolutely predicted how and how fast a disease will spread, so a buffer zone or restricted area can never be absolutely sure. They therefore question the way TSN is looked at, and they believe the application is not as legitimate as one would expect.

Linked to this is the belief that some could use TSN for their own agenda, while the margins of error are so large, one measure would look better than another. By programming the calculations one could automatically make sure some measures will mostly, or always, come out better as others. However, even by taking the margins of error into account this cannot be proven. Those with access to TSN claim that even though the margins of insecurity do indeed exist they do not use them for their own agenda.

Another important value which needs to be mentioned in the case of TSN is privacy and the right to run ones own business. Farmers, as mentioned, fear that TSN will cause even more rules and regulations, and will eventually force them to provide even more information on their farm than they already have. They claim their privacy is violated and it is impossible for them to run a farm when they have to do this enormous amount of paperwork.

Power

The third building block of the conceptual framework of agenda-setting is perceived power; this is linked to the conflicts of values since those with the most relative power will be more able to push their issue towards agenda status (Bachrach & Baratz, 1970; Sabatier, 1993; Dahl, 1961).

In the case of TSN there are a number of instances in which the variable power becomes very visible. First of all this can be seen in the shift of power from policy-makers to experts in the field of contagious live stock diseases. Where some choices were made by politicians before the use of TSN, now with the calculations and the up-to-date data these choices are made on the basis of outcomes of calculations made by TSN and experts. Even though the margins of insecurity are very high, still the outcomes are regarded by policy-makers as a rational, correct calculation based on hard numbers. In this way, especially in the debate between vaccination and killing animals, a lot of power has flown to experts. This is also linked to the visualization function, now experts are able to explain very specifically to policy-makers what should be done. This shift from politics to experts is correspondent with Winners thesis on this (Winner, 1977).

Secondly it can be found that because of the use of TSN experts on contagious live stock diseases are divided into those with access to TSN and those without. Those without access cannot do any relevant research any more since they do not have any data. The power of the experts therefore has moved to one group, those with access, leaving the other group merely powerless.

Furthermore TSN itself, according to some is a source of power, the access to the application makes sure that one can push issues forward. Since German policy-makers trust TSN and consider it legitimate, one can push problems further, and make sure live stock diseases are still on the agenda. According to some TSN is used to exaggerate the scale of problems or the scope of the threat to make sure that money and time will be spent on live stock diseases.

Finally TSN accounts for a conflict with farmers. The farmers claim that those with access to TSN leave them entirely powerless and they feel subject to any random rule that they make. They believe their farm and their business is their own and more rules and regulations would make it impossible to farm. They fear they have to provide more information on their farm than they already have and they feel very threatened by this.

Formal Institutional Features

Moving over to a more structural variable in the conceptual framework of agenda-setting, the formal institutional features must be discussed. These institutional features, like legislation but also the formal power of organizations, can determine the scope of what is possible and what is not (Bachrach & Baratz, 1970; Sabatier, 1994).

In the case of TSN it can be said that the formal institutions had a large impact on TSN. First of all, now and in the past there always has been an enormous amount of rules and regulations, on contagious live stock diseases. They way prevention and containment is handled is very formalized. This has to do with the large impact live stock diseases have on the economy, since they can affect the economy severely formal rules are laid down. TSN had to be implemented, there was no room to argue this, European regulations asked for an application, the Germans choose TSN.

This helps agenda setting severely, the fact that live stock diseases have always been on the agenda, and the enormous amount of rules make sure they stay on the agenda. This makes sure that attention for live stock diseases, at least on the side of policy-makers does not fade.

Nature of the Issue

The nature of the issue, as opposed to the content is also important here (Cobb & Elder, 1972). Where the content deals with what the case is actually about the nature deal with five dimensions of the case by which expansion to a relevant public can be explained. It is then assumed that the degree of expansion is determinant for the chances of obtaining agenda status.

On the first dimension, the dimension between concrete and abstract, the issue is fairly concrete. Live stock diseases are something we can see and imagine. Therefore the issue will not expand easily, on an abstract issue everybody can stick their own values and norms, on a concrete issue they cannot.

The second dimension deals with the degree to which an issue is either general or specific. TSN deals with a fairly general issue, live stock, farming and land use. This should account for an easy expansion of the issue, but this is not the case. According to respondents people are simply not interested unless an outbreak occurs and they are hindered in their mobility.

On the third dimension, the dimension distinguishing between long term and short run, live stock diseases are very long term. This should also help the issue to expand.

The fourth dimension deals with a complex versus a simple issue. Live stock diseases are very complex. The large amount of rules and regulations make it difficult for people to understand what is allowed and what is prohibited. The nature of animal diseases and containment is very difficult, the calculations are hard to explain and a large number of variables are involved. This would also make the issue difficult to expand. It must be mentioned that because of the visualization function of GIS, the calculations demonstrated in the form of a map become a lot simpler to understand.

The final dimension deals with whether the issue is routine versus extra ordinary. Here it is clear the issue is routine, since the Middle Ages countries are dealing with live stock diseases. This makes expansion difficult as well, since the issue is not new people are less interested.

Summarizing this, we see the issue on the first, fourth and fifth dimension should not expand easily but on the second and third should. In practice the issue does expand among policy-makers, where departments of agriculture would deal with this alone before; now we see that departments of economics finance and the military are also involved. On the side of citizens there is no expansion, unless their daily lives are involved in the case of an

Table 9.1: TSN and the Dimensions of Expansion

Dimension	Riskmap	Expansion
Abstract vs. Concrete	Concrete	Less likely to expand
General vs. Specific	General	More likely to expand
Enduring vs. Short-term	Enduring	More likely to expand
Complex vs. Simple	Complex	Less likely to expand
Routine vs. Extraordinary	Routine	Less likely to expand

outbreak.

Policy Window

Finally the last concept in the conceptual framework of agenda-setting to be discussed is the policy window. This is the opportunity for advocates of an issue to push their issue forward towards agenda status (Kingdon, 1995).

In the case of TSN there are two points to be made on the policy window. First of all it must be said that live stock diseases were always an important issue, also because it affects the economy at large. However there are two open policy windows to be distinguished which pushed contagious live stock diseases much further on the agenda. Firstly this was the outbreak of mouth and foot disease in Europe in 2001. This outbreak affected the economy, trade and finances in Europe severely and made sure live stock diseases became a hot issue. It also made sure that live stock diseases were not only the problem or responsibility of departments of agriculture anymore but also of economics and finance.

The second opening of a policy window was caused by TSN itself, by the existence and use of TSN live stock diseases are placed on the agenda and kept there. According to some the scope of the threat is very much exaggerated. Since outbreaks can be predicted as well as how the course of these outbreaks will proceed, and while this can be demonstrated in the form of a map or movie, policy-makers can understand what experts are talking about. By the sheer existence of TSN dangerous situations in farming can be found and ask for new regulations, placing live stock diseases on the agenda over and over again. This also makes sure that a large amount of money is spent on the matter, nationally as well as European.

To summarize this briefly, a number of things can be found, firstly in terms of mobilization of bias. Some experts are organized into the application and some are organized out, this makes sure those who are organized out lose power to a large degree and in terms of agenda potential they are merely powerless. Secondly some would like to expand TSN into a larger application incorporating more issues. Thirdly TSN itself holds an inherent bias towards some measures and solutions over other solutions. In terms of power, values and beliefs it was demonstrated that those organized out of TSN lose power significantly and those organized in gain significantly, they communicate their calculations to governments and make choices on the basis of these calculations. They hold the monopoly on information and outcomes. Also they can use TSN, according to some, for their own agenda, since TSN favors some solutions over others. Farmers have also lost power significantly resulting in them having less to say about their farm. When speaking of formal institutions it can be seen that since live stock diseases have always been on the agenda they help agenda setting, the enormous amount of rules and regulations account for that. The nature of the issue neither hinders nor helps agenda-setting. On some dimensions the issue should theoretically expand and on some this should be hindered. In practice the issue does expand but only between experts and some fields of policy, this issue does not expand to the public. The policy window had a large impact, the outbreak of mouth and foot disease in Europe in 2001 caused a shock wave of the economical damage an outbreak could do, making sure funding was given to further develop TSN. The application itself makes sure that the subject stays on the agenda.

9.4.2 The Influence of TSN on Agenda-Setting

After looking at the variables making up the conceptual framework of agenda-setting, the building blocks, now it is time to look at the case of TSN in the conceptual framework of agenda-setting in order to find what the perceived influence of GIS is on agenda-setting in this case.

In chapter 6 it has been explained that the conceptual framework of agenda-setting exists of three parts and four channels of interplay.

The first part is the policy sub-system, the space where relevant actors interact with one another (Sabatier, 1993). It becomes clear there are several parties to be distinguished, first of all the German farmers, secondly the experts on contagious live stock diseases. These can be subdivided into the veterinarians in the Tierartzenkammern, the Friedrich Loeffler Institute and researchers in other organizations like universities. A third group are researchers on nutrition and consumer protection, linked to live stock diseases. Fourthly there are the policy-makers on the national and European level in the field of agriculture, and in the case of an outbreak also of finance. When placing these players in to advocacy coalitions we can see the farmers as a first coalition. The other coalitions are difficult to distinguish between, the experts with access to TSN, the veterinarians and the Friedrich Loeffler Institute, form one coalition and the experts without access to TSN form another coalition. In another matter the substance of the coalitions are different, where some experts believe that TSN should be expanded others do not. This is not to be organized along the lines of the organizations involved and the coalitions are thus made up out of experts from several groups. Another coalition consists of the policy-makers in the national government and the policy-makers in the European government.

In the policy sub-system the different advocacy coalitions function within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995; Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). Not all coalitions agree on what TSN is and should be and the disagreement cannot be organized around organizational boundaries. All actors do agree that TSN is a good source for up-to-date information. But on who should be granted access, and whether TSN should be expanded, whether its results are reliable and whether it is a political tool there is no agreement.

Furthermore all the actors in the policy sub-system use their relative power to gain agenda status for their issue (Bachrach & Baratz, 1970; Cobb & Elder, 1972). The position of the experts with access to TSN has improved at the expense of other experts, policy-makers and farmers. The experts with access to TSN have the power to place contagious animal diseases and new measures on the agenda and they do so, in a very successful manner. Even though land use itself is not placed on the agenda, these experts seem able to keep contagious animal diseases a hot item on which money is spent. The other actors, losing power, are not very pleased with this and do not have the power to gain agenda status for any issue they deem important. The national government as well as the European government tends to listen to those with access to TSN since they are the ones with the accurate data.

The second part of the conceptual framework of agenda-setting deals with the characteristics of technology. Here it becomes clear not all parties agree on what TSN actually entails. Those with access but also policy-makers and politicians agree that TSN is a tool for up-to-date information and is very valuable in making calculations and simulations so policy can be made. Others believe TSN to be a tool for exclusion; those working in the food chain believe they are excluded but other actors within the field of live stock diseases feel so as well. Furthermore, some believe TSN is used to push ones own ideas forward, since the application can be manipulated. Closure on the meaning of technology on what TSN is therefore has not occurred, it is not the case that all agree on the meaning of TSN. Additionally, stabilization has not occurred either, even within groups there is disagreement on who to include, which topics to include and how far to expand TSN.

Moving over to the third part of the conceptual framework, namely the structure, it can be seen that three factors within this structure influence the policy-subsystem. Firstly there are the formal institutions (Bachrach & Baratz, 1970; Sabatier, 1993). These help agenda setting severely, since everything in contagious live stock diseases is so much formalized and deals with an enormous number of rules and regulations, the issue simply stays on the agenda. This happens not only because the fear exists an outbreak will occur but also because so much money is involved. Secondly the nature of the issue influences the policy sub-system, (Cobb & Elder, 1972). While the nature of the issue, as explained, would neither help nor hinder the issue to expand in theory, in practice the issue does expand on the governmental level. More departments deal with contagious animal diseases than before but the issue does not expand to the public since the public does not seem to be interested. Finally the policy window influences the sub-system (Kingdon, 1994). The opening of the policy window in 2001 made sure attention was paid to contagious live stock diseases and money was available for prevention and containment. Also this made way for new rules and a boost in the development of TSN. The existence of TSN itself did the exact same thing, and accounted for new solutions and problems in the field of contagious live stock diseases, making sure an opportunity for them to be pushed forward was present.

Looking at the conceptual model as a whole there are four channels. First of all there is the channel moving from the structure to the policy sub-system. This structure mostly enables the coalition made out of experts with access to TSN pushing their ideas forward towards agenda-status, as explained above.

Secondly there is the channel from the policy sub-system to technology. Here technology, thus TSN is made or shaped by the technological frames of the advocacy coalitions (Bijker, 1995, Orlikowski, 1992). There is a lot of argument on what TSN actually is. Within the advocacy coalitions there is no stabilization and between the advocacy coalitions there exists no closure on the meaning of technology. All technological frames seem to be incongruent and this makes room for debate on what TSN is and should be.

Thirdly there is the channel from technology moving towards the policy sub-system. Although actors have shaped the technology and made it into what it is now, technology within the meaning it has been given facilitates and constraints human action in the policy sub-system (Orlikowski, 1992). While neither closure on the meaning of technology nor stabilization has occurred, the technology of TSN is not shaped as an artifact at this point. This means that the actors in the policy sub-system still operate within their individual technological frame, this makes consensus difficult. However, the experts with access to TSN have shaped TSN and since they are the prime source exerting power, still they can influence this channel. It can be seen that how they have defined TSN influences the policy sub-system and especially the policy-makers, since they regard TSN as legitimate and rational tool.

The final channel moves from technology towards structure. After the actors in the policy sub-system have shaped technology and closure on the meaning of technology occurs, the established technology will influence the structure, new rules and laws might be made and it will be embedded in the culture (Giddens, 1984). So the structure is a result of previous actions (Orlikowski, 1992). Since closure on the meaning of technology has not occurred the technology cannot influence the structure, in this case. Again it can be found that even though closure on the meaning of technology has not occurred; those experts with access to TSN have power to such a degree that they are able to influence structure through the technology. New rules are being made on prevention and containment on the basis of the outcomes of calculations made in TSN.

9.5 THE SECOND ARENA, DESIGNING TSN

Again as in previous cases the second arena can be found, here again a second arena emerges in which policy needs to be designed on the application of TSN itself, who gets access, what the content of TSN should be and how far TSN should be expanded. All actors in this arena, like in previous cases have their own ideas on how TSN should look (Markus, 1983; Goodhue et al., 1992). In this section the second arena will be looked at.

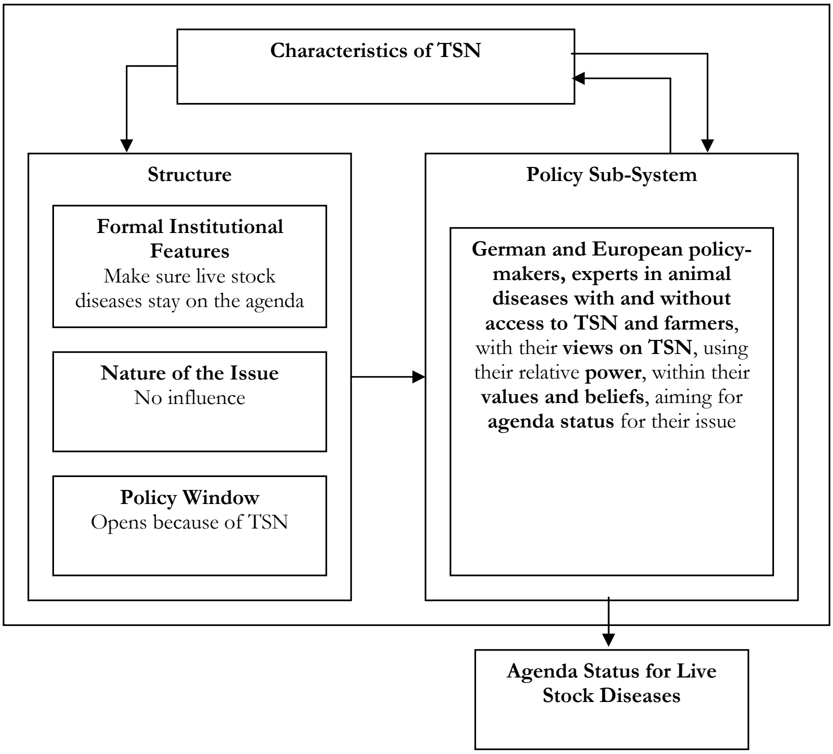

Figure 9.5: The Conceptual Framework of Agenda-Setting

9.5.1 TSN and Policy Design

Before moving to the conceptual framework of policy design it is important, as for agenda-setting, to look at the variables taken out of the existing models, the building blocks of the conceptual framework of policy design. Bounded rationality will be dealt with first, secondly satisficing, thirdly conflicting values, fourthly power, fifthly formal institutional features, sixthly rules in use and finally culture.

Bounded Rationality

The first important concept in the conceptual framework of policy design is bounded rationality. Bounded rationality refers to the inability of humans to function and act completely rational. Humans are bound in their ability to list all consequences of all possible alternatives (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968).

This is to be seen in the case of TSN. There are some instances in which the bounds of rationality have decreased but there are also instances in which they have increased.

First of all there is a decrease in the bounds of rationality on the side of the national and European government. Before they were very unaware of what prevention and containment of contagious live stock diseases was all about, data was dispersed. There was no clear way of explaining difficult data to policy-makers with no real knowledge of veterinary affairs. Now with the use of TSN this information is clear since it can be communicated more easily in the form of a map or a movie. The calculations made to predict the speed and scope of a potential outbreak also make sure government agencies know what they are doing and decisions can be made based on a more rational way of reasoning. This decrease in rationality can also be seen by the experts with access to TSN. They now have the data to make these calculations to predict scenarios in case of an outbreak.

On the other hand the bounds in rationality also have increased. This can be found on the side of the experts without access to TSN. The decisions in their work are far less based on a rational way of thinking because they no longer have the information they used to have. All relevant information is now in TSN and they cannot access this. Furthermore, they doubt whether the information in TSN is correct. The data is seen as trustworthy and up-to-date but the calculations made in scenario sketching are not. Since the margins of error are so large the scenarios which are presented as 'truth' might not be correct at all. These experts claim that while governments believe they are making a more rational decision based on the scenarios, they are actually not. Governments, according to these experts, are following the line of thinking and the values of the experts using TSN. Due to these margins of error and the insecurities within the calculations bounds of rationality increase.

Finally on the side of the farmers the bounds of rationality have decreased. Where in other cases we saw governments had no idea of the consequences of implementing the application, in the case of TSN this is not so. Governments seem very aware of the consequences of implementation, but the farmers do not. They fear more rules, more regulations, more paperwork and more restrictions. This fear comes down to the fact that they are not aware of what the impact on them of implementing TSN is and therefore the bounds of rationality on this point have increased as well.

Satisficing

The concept of satisficing is the second important concept in the framework. Satisficing holds that since there exist bounds in rationality, actors should search for a satisficing solution instead of an optimal one (March, 1994). This comes forward on several occasions in the case of TSN.

Firstly in the case of TSN there are some instances of optimality, a large group of experts with access to TSN believes the way TSN operates at this point is the way they indented it to operate. Therefore they regard TSN as the optimal solution to prevent and contain contagious live stock diseases.

On the other hand there are some who believe TSN is not optimal at all. Firstly these are the experts without access to TSN. They believe they should have access. In their vision

TSN is a tool for pushing only one opinion forward. Secondly there is a group of experts in another field than containing live stock diseases who believe TSN should be expanded. They agree with the functionality of TSN but they believe optimality can only be achieved if TSN is expanded. The way of expansion would then lie in the field of consumer protection and nutrition. Animal diseases like salmonella or mad cow disease should not only be looked at on farm and transport level but also on the level of consumer protection. At this point TSN does not incorporate this and in the near future it looks like it will not either.

Conflict of Values

In terms of conflict of values, a third variable in the conceptual framework of policy design, (Etzioni, 1967) we see a few instances in implementing TSN. This is important since these conflicts are the conflicts in the end making up the final design policy for TSN. Three conflicts stand out in the implementation of TSN.

Firstly the conflict on who is granted access to TSN, the matter of exclusion is at stake here. Only the Tierartzenkammern, the Friedrich Loeffler Institute and some smaller organizations were granted access, the other organizations were not. Research institutes, universities, and consumer protection agencies are not able to access the databanks of TSN. This caused conflict since those without access demanded access and those with access were not very willing to share their newly found power. In the end, the rules for granting access remain the same.

A second conflict is not on who is included into TSN but what is included into TSN. This is a conflict on how far to expand TSN and how much to integrate within the application. As described, some experts would like to expand TSN from not only an agricultural application to a nutrition and consumer protection application. The experts with access to TSN do not wish to do so for two reasons. Firstly they fear that when these issues are also included TSN will become a political tool since different political values will be at stake. These include issues such as environmental issues, biological versus conventional farming also environmental organizations and organizations for animal rights will become involved. It is believed this would compromise the neutrality of TSN. Secondly they are opposed to expanding TSN because they believe the application would become too large, and would incorporate too many things making an oversight impossible. Access to data would be much dispersed and the functionality of the application would be at risk. Farmers are also opposed to expanding TSN, they feared animal rights organizations would become involved and also that they would be subjected to stricter norms in terms of consumer protection.

A third cause for conflict deals with legitimacy, the insecurities and the margins of error in the calculations within TSN. Here the experts with access to TSN regard TSN as neutral, correct and trustworthy, and sell the results to policy-makers as such. The experts without access consider the calculations an estimate at best. Since the margins of error are very large these predications, according to those experts, cannot be made at all and these insecurities should be incorporated in the explanation. They accuse the experts with access that they use the insecurities to make sure their issues can be pushed forward.

Power

The fourth building block, perceived power, is linked to the conflict of values; here it is important to keep in mind that the actor with the most relative power is more likely to see his views back in the final design (Etzioni, 1967; Dahl, 1961). In terms of power a few things must be mentioned in the TSN case.

Firstly the enormous shift in power TSN caused between experts. Before implementing TSN the experts of the Friedrich Loeffler Institute were already in a privileged position. The Friedrich Loeffler Institute was, together with the Tierartzenkammern, the prime source for informing the government and researching prevention and containment of contagious live stock diseases. But other experts had power as well; their research and their ideas were also taken seriously. Now in implementing TSN this has changed. It is important to note here that TSN was implemented very gradually, first it existed next to other applications and its functionality was improved and expanded over the years. In this process the experts without access gradually lost power until the point where they had no way of receiving up-to-date information. Those with access to TSN have the monopoly on information and government communication. Their vision and their ideas, as calculated by TSN are seen as the solution and are believed right away, leaving other experts and researchers merely powerless.

In the process of implementation farmers have lost a fairly large deal of power. Before they had much more say over their own farm. Now with TSN, they are forced to provide information and to log every instance of a potential outbreak.

Large protests from farmers were not to be seen, neither were there large protests from experts without access. This comes down to one issue, namely that TSN had to be implemented. The European Union asked for an application for information, prevention and containment of contagious live stock diseases, and demanded this to be implemented. After the outbreak of mouth and foot disease in 2001 this demand became even more severe. The federal German government asked for TSN and wanted the Friedrich Loeffler Institute to design it. Since this was and is the prime organization in the field with the knowledge and the resources this was not contested. Since the regulations for TSN were laid down by the European Union and the German federal government this was not to be contested either. Room for discussion was impossible.

Formal Institutional Features

Next to the variables and concepts in the action arena there are also concepts relating to structure in the conceptual framework of policy design which must be dealt with.

Firstly these are the formal institutional features, the legal framework and the institutions involved (Ostrom et al., 1994).

In the case of TSN the formal institutions helped the implementation of the TSN. As described above, the European Union as well as the German federal government wanted an application being able to hold a large database, calculate, predict and log. The implementation of TSN therefore moved very smoothly since there was no room for discussion. The German federal government delegated to the Friedrich Loeffler Institute to decide on the specific form and contents as long as it fitted the goal. Discussion on the content and form was therefore not possible since it was all laid down by law and other organizations and the farmers simply had to accept this. By leaving political values dealing with consumer protection, nutrition and animal rights out, the government made sure interest groups in the field were not able to become involved. For these reasons the implementation of TSN moved very smoothly.

Rules in Use

Next to the formal institutional features the rules in use are important as well. These are the informal rules, the codes of conduct and the relations between actors (Ostrom et al., 1994; Stone, 1997). Three rules in use must be discussed in the process of implementing TSN.

Firstly it is important that, as mentioned, an application like TSN was obligatory. Discussion on the right of existence of the application and its headlines was impossible.

Furthermore it is important to note as a rule in use that contagious live stock diseases have been an issue for decades if not centuries. The issue is not new and the threat of an outbreak is very old as well. The Friedrich Loeffler Institute had always been the prime organization dealing with this, communicating with the German federal government and holding the latest information. As a rule in use it is therefore no more than expectable that the Friedrich Loeffler Institute had the most say in the development and implementation of TSN.

Another rule in use in the implementation of TSN is linked to the conflict on who should have access. In communication with governments only those with access to TSN are invited to the negotiation table. The government, federal as well as the states, consider TSN to be trustworthy and know that other experts do not have actual data. What happens is that those without access to TSN, and with possibly another vision on containment and prevention of contagious live stock diseases are not invited. They are therefore not able, to communicate their opinion to policy-makers.

Culture

The final concept to be discussed here on the structure side of the conceptual framework of policy design is culture (Ostrom et al., 1994).

In the implementation of the TSN there was a clear culture of the German federal government and the Friedrich Loeffler Institute to hold everything in its own hands. They had laid everything down by law and discussion was not an option for other parties.

Additionally the trust the government places into TSN demonstrates a culture in which is believed that when measuring something in hard numbers it is seen as true. The insecurities and the margins of error are neither taken into the policy design nor into the decision-making process. It is believed that as long as something is calculated it must be right and unambiguous.

A final note on culture that is very important in the process of implementation of TSN is that the issue of contagious live stock diseases is something which the Germans have dealt with for centuries. Since the Middle Ages the fear of an outbreak leading to poverty, hungers and severe economic damage was present. This long culture and long history of dealing with the issue made implementation easier and made sure that little discussion took place on whether TSN was needed or which organization should organize TSN. The Friedrich Loeffler Institute was already present and was already the prime organization dealing with the matter. Because of this implementation moved very smoothly.

Summarizing this it can be found that the bounds of rationality are lifted on the side of the government and on the side of the experts with access to TSN. They now have information and can make predictions which can easily be communicated. On the side of the experts without access to TSN the bounds of rationality have increased, they have no information. Furthermore the margins of error within TSN also increase the bounds of rationality, where it would look rational to make a choice on the basis of a calculation the inherent margin of error lessens the rationality. Farmers also see an increase in the bounds of rationality while they do not know what the implementation of TSN will mean for them. In terms of satisficing, power and conflict of values we see that some experts are very satisfied with TSN. Those are the experts with access and the government. Others do not, they want to be included as well or they would like the application being expanded so they would become a part of it. In implementing TSN the only real power laid with the government since they ordered the application to be designed and implemented. Power also laid with the Friedrich Loeffler Institute which filled in the details. Discussion on content or functionality of the application was impossible. In terms of formal institutions the German federal government together with the European Union demanded an integrated application and the Friedrich Loeffler Institute was ordered to design the application. The rules in use do the exact same thing, making sure that only those included into TSN are invited to the negotiating table, leaving those with different views out. For culture it can be said the culture of dealing with live stock diseases for a very long time made sure that implementation moved smoothly. Finally a culture in which is believed that anything that is calculated by a hard number is probably true, makes TSN a very legitimate and trustworthy application.

9.5.2 The influence of TSN in Implementing

After filling in the blanks in the variables, say the building blocks, of the conceptual framework of policy design in the case of TSN, now the case of TSN and its implementation process can be placed into the conceptual framework of policy design.

As for the conceptual framework of agenda-setting, and as seen in the previous case studies the conceptual framework of policy design starts of with three parts. The first part is the action arena (Ostrom et. al. 1994). This is the space in which all involved parties interact. There are several groups of actors in the policy design process of TSN. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

When looking at the different actors the same actors as in the agenda-setting arena are present: The German federal government as well as the states, the European Union, the experts on contagious live stock diseases from several organizations like research institutes, universities, the Friedrich Loeffler Institute, and the veterinarians organized in the Tierartzenkammern. We also see the farmers and the researchers on nutrition and consumer protection.

When putting these into coalitions or groups, these groups are made up differently. The German government is in one coalition, the European Union in another coalition and the farmers are in a coalition. But then the coalitions look differently than in the area of agenda-setting. Firstly the Friedrich Loeffler Institute forms a coalition of its own, while it had the task of designing TSN. The other experts with access to TSN form another coalition. The experts without access form a coalition, but the experts on nutrition and consumer protection, form a separate coalition. This because as long as TSN is not expanded they do not need to have access, the information in TSN is not relevant to them.

These coalitions within the action arena try to push their ideas towards a policy design on the implementation and design on TSN. Depending on their relative power they will be successful to a more or lesser degree.

The second part of the conceptual framework is constituted of the characteristics of technology itself. Here the same can be said as in the conceptual framework of agenda-setting.

Neither closure on the meaning of technology nor stabilization has occurred and actors do not agree on what TSN means. Some consider it the solutions, others consider it a mean for exclusion, a tool for ones own political agenda or simply untrustworthy.

The third part of the conceptual framework of policy design is structure; this structure influences the scope of actions possible in the action arena. The structure consists of three different parts. Firstly there are the formal institutional features (Ostrom et al., 1994). The formal institutions helped implementation of TSN by favoring the German federal government. They laid down the law and thus had the power to set down the rules before other parties joined in. Only the Friedrich Loeffler Institute was party to designing TSN and they had significant power in this matter. The rules in use do the exact same thing (Ostrom et al. 1994). They give the German federal government together with the Friedrich Loeffler Institute more power and enable experts with access to TSN to become part of negotiations. In effect this makes sure only one vision on contagious live stock diseases is communicated. Finally the culture is important (Ostrom et al., 1994). The culture is coherent with the institutional features and the rules in use, the law was laid down. Furthermore a culture of believing hard numbers are true makes sure TSN is trusted. A long history and culture of dealing with contagious live stock diseases made sure implementation moved smoothly.

After dealing with the three parts of the conceptual framework of policy design the four channels of interplay must be dealt with.

The first channel moves from structure to the action arena, influencing the interaction there, this proceeded as described above.

Secondly there is a channel moving from the action arena to technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artifact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992). Closure on the meaning of technology has not occurred, those without access to TSN consider TSN untrustworthy and a political tool, those in the field of consumer protection and nutrition consider TSN incomplete. TSN was designed by the Friedrich Loeffler Institute who made sure they shaped it as a neutral tool with up-to-date and trustworthy information so containment and prevention of live stock diseases would become far more advanced. Since the experts with access to TSN are the only ones communicating with the government and since they all hold the same view in the matter, the German federal government as well as the states see TSN as such. The experts who hold a different view on what TSN entails do not have a real voice in terms of communication with governments, and neither do the farmers.

This brings us to the third channel, the channel moving from technology back to the action arena, even though not all actors agree on what TSN is, TSN as shaped by the Friedrich Loeffler Institute does affect the action arena. As described, TSN left some groups almost powerless and they do not have any leverage to communicate with policy-makers. In this way, even without closure on the meaning of technology the implementation of TSN made sure the action area was severely affected. Within the meaning it has been given by its designers TSN facilitates and constraints human action in the action arena (Orlikowski, 1992).

Finally there is the channel from technology to structure. After the actors in the action arena have shaped technology and closure on the meaning of technology occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984).

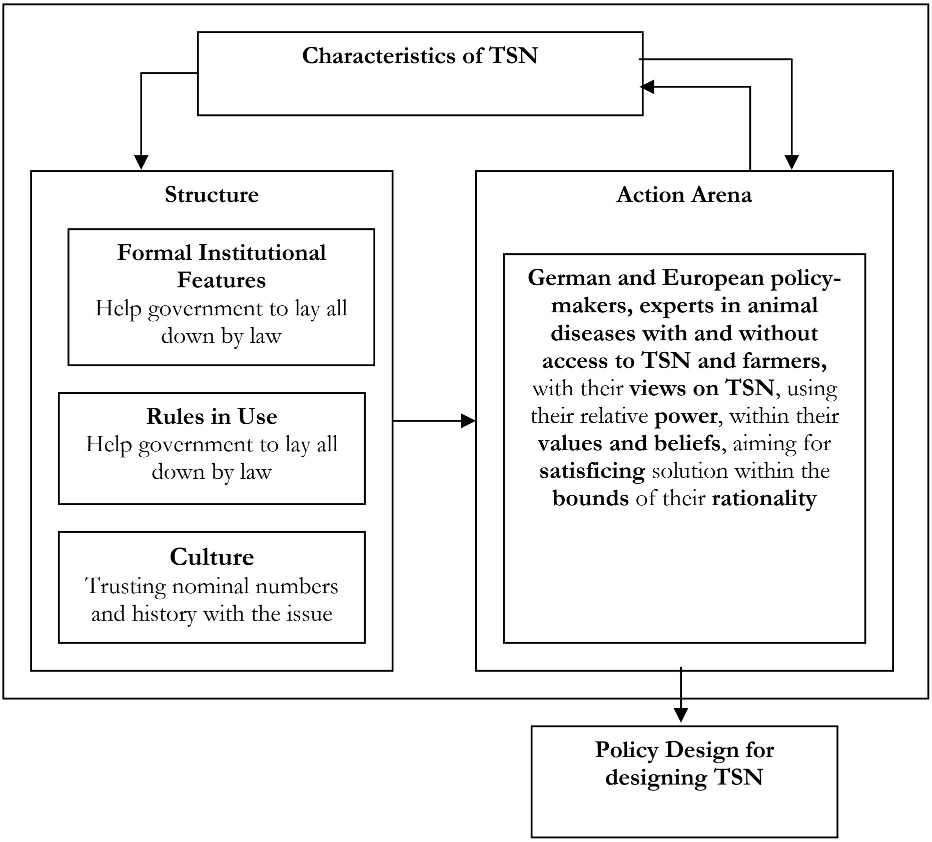

Figure 9.6: The Conceptual Framework of Policy Design

Here again, closure on the meaning of technology has not occurred. Those who disagree with the meaning of TSN given by the Friedrich Loeffler Institute have no power, they have no data and are not invited to negotiate. They have no voice; therefore TSN is seen as shaped by the government and by policy-makers and it does influence structure.

9.6 CONCLUSION

When coming back to the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?" first of all it must be concluded that when dealing with the influence GIS have that next to the arena in which agenda-setting occurs simultaneously another arena arises on how to design and how to implement the GIS at stake. We see this in the TSN case as well. Therefore we must deal with both arenas.

First of all it can be noted that TSN with its GIS component has an influence on agenda-setting when looking at the qualities and effects GIS are said to have. First of all this can be seen by the linking of different datasets. They were formerly dispersed but now they are incorporated into TSN. This makes sure that new data becomes visible. With this new data calculations can be made and scenarios of spreading can be tested as well as effects of measures. Information can be used when trying to place some measure on the agenda.

Linked to this is standardization, TSN makes sure that communication between experts moves more smoothly. Now by using the same application they can form a block and push their ideas towards agenda status.

Secondly by calculation agenda-setting for the experts with access to TSN becomes a lot easier. By making the difficult calculations they can predict how a potential outbreak will proceed and which measures can have which effects. Through these calculations and the result of these calculations experts can have a profound impact on agenda-setting. They can make sure, since they have the monopoly on information, their idea of prevention and containment will prevail and will receive agenda status.

Furthermore the ability of TSN to visualize complex and difficult data in the form of a map accounts for experts communicating their idea to policy-makers. The policy-makers can now understand the issues at stake. This makes sure that not only experts can notify government officials of their view on containing and preventing contagious live stock diseases but it also becomes a lot easier for them to push their issue forward. A map or a movie of an outbreak says more than a thousand words.

A direct effect of all the above is improvement of communication. Experts now communicate with one another in the same application they use the same vocabulary and are now able to function as a block in pushing their ideas forward; this could help their cause a lot.

Also transparency for the experts with access to TSN and the governments, national and European has increased by using TSN; this made agenda-setting a lot easier. Because of this transparency, contagious live stock diseases remain on the agenda.

An influence from GIS on agenda-setting can be found when looking at the conceptual framework of agenda-setting.

First it must be noted that TSN has a significant impact within the policy subsystem. This is first pointed out by the concept of mobilization of bias. Before the use of TSN all experts in the field of contagious live stock diseases worked together. Now with the use of TSN they do not anymore. A clear separation has occurred between those experts organized into TSN and those organized out. This is also visible in the dispersion of power and has caused conflict. The actors with power have a clear advantage in terms of information but also in terms of leverage. They have the information to push their ideas forward and to secure agenda status for their issue, where experts without access to TSN do not. Policy-makers will only invite those to the negotiating table who have information which in this case means only those with access to TSN. For agenda-setting this means that the views of those without access on prevention and containment of outbreaks of contagious live stock diseases will not be heard and they have no real power of getting their ideas on the agenda.

Secondly the relations in the policy sub-system have changed because of TSN on the question on whether TSN should be expanded. The experts in the field of consumer protection and nutrition already noticed that TSN is a very powerful tool by which issues can be placed on the national as well as European agenda. They want to be organized in as well. The sheer knowledge that an application can give a group of actors this kind of legitimacy seems appealing to other groups making sure they will try to be incorporated.

What is also important is to realize that TSN in itself holds a bias. They way the application is programmed fits the ideas of the Friedrich Loeffler Institute, making sure that some measures come out of calculations better than other measures. This is due to the margin of insecurity made in these calculations. This again gives the group with access to TSN enormous power in the field.

It must also be noted that the subject of these measures, the farmers see that because there is one incorporated application in use, TSN, their power has seriously diminished. They do not have the power to demonstrate against any measure coming out of TSN since the German federal government believes this measure to be correct.

When looking at the structure we see that this neither helps nor hinders the agenda-setting process, formal institutions make sure that a lot of rules and regulations are laid down. A culture of dealing with contagious live stock diseases makes sure that it always was a topic. Furthermore the nature of the issue neither helps nor hinders expansion since the public is not involved in the matter since the matter is too complex and citizens seem not to be interested in contagious live stock diseases. The policy window, opening in 2001 after the European outbreak of mouth and foot disease did help and made sure funding was given to further develop and expand TSN. It must be noted that the sheer existence of TSN accounted for a policy window in itself. The fact that such an application existed made sure contagious live stock diseases where a hot item .

What is very interesting in the TSN case is closure on the meaning of technology, this has not occurred, not all agree on what TSN is. Those with access believe it is a neutral tool which can help to make sure contagious live stock diseases will be handled more effectively. Those who do not have access consider it a tool for pushing certain views forward. They regard TSN as a political instrument of the Friedrich Loeffler Institute and of those who agree with the institute. What is interesting is that even when closure on the meaning of technology has not occurred still the technology is shaped and influences both the policy sub-system and the structure. In the subsystem it has changed power relations dramatically and in the structure it can influence guidelines for new rules and measures in preventing and containing live stock diseases. This can be explained by the idea that those who are in favor of the views of TSN are those with power. So even though closure on the meaning of technology has not occurred, the dominant group seems to be able to make sure technology is shaped anyway and influences structure. This leaves the group which disagrees to stand at the sideline.

What is very interesting is that, again, next to the arena of agenda-setting another arena emerged, as seen in previous cases as well. This is the arena in which has to be decided on how to use and design TSN. In this arena several important instances occurred.

First of all the bounds of rationality are lifted on one side but have increased on the other side. They have decreased on the side of the government and on the side of the experts with access to TSN. Now information is up-to-date and predictions can be made, which also can be communicated to the government in an understandable way. On the other hand, the experts without access to TSN do not have any information and their bounds of rationality have increased. Furthermore they claim the margins of insecurity are so high that these predictions itself are an estimate at best, making the rational decision look less rational. On the side of the farmers we see that the bounds of rationality have increased since they fear the consequences of implementing TSN. They are worried that more rules and regulations will be imposed, which will make farming more difficult.

Secondly in the fields of satisficing, power and conflict of values, some experts are very satisfied with TSN. Those are the experts with access and the government. Others do not agree so much, they would like to be included as well or they would like the application to be expanded so they would become a part of it. In implementing TSN the only real power laid with the government since they ordered the application to be designed and implemented. Also power laid with the Friedrich Loeffler Institute which filled in the details. Other organizations or farms had no say in the matter and had to stand by while the application was implemented.

On the side of structure the same can be found. Since the German federal government together with the European Union demanded for an integrated application and the Friedrich Loeffler Institute was ordered to design the application implementation moved very smoothly. This did not happen because everybody agreed but because there was no room for discussion or alteration. The rules in use do the exact same thing. They make sure that only those included into TSN are invited to the negotiating table, leaving those with different views out. For culture it can be said the culture of dealing with live stock diseases for a very long time made sure the question whether TSN was needed was not asked. Finally a culture in which is believed that anything that is calculated by hard numbers is probably true makes TSN a very legitimate and trustworthy application.

When looking at what these conclusions really mean for the influence of the perception and use of GIS on agenda-setting and policy design three main conclusions must be drawn.

Firstly the TSN case shows us that technology and thus GIS can hold an inherent bias. In the TSN case this comes forward to a large extent. Those who are organized out of TSN claim they were organized out because they hold a different view. What this actually means is that when one group of actors designs an application, such as TSN, it becomes possible to incorporate their views and values into the application. In the case of TSN there is no other application which generates information so those with access hold a monopoly. Because of this monopoly they are the only ones invited to negotiate on policy. This thus reinforces the bias. The way TSN was designed made sure some values were programmed into TSN and the way TSN was implemented made sure only those values were heard. This gives the designer of the application as well as the initiator an enormous advantage in terms of power.

A second conclusion which relates to the first is the point in which decisions which were formerly made by elected politicians are now made by experts. Because GIS is able to calculate very complex and large datasets, and because GIS can visualize this in a comprehensive way politicians trust the outcomes of these calculations. A culture in which nominal numbers are trusted adds to this. The decision is now made by the calculations made instead of by political values of those elected. The calculations however, may hold a bias but may also be incorrect due to large margins of error.

A final conclusion that must be drawn which is of particular interest in this case is that GIS can create the opening of a policy window. This is seen in other cases as well. What makes it different in this case is that actors made sure to use the GIS application in such a way that live stock diseases became a pressing matter. TSN opened a policy window for pushing new ideas forward, but by emphasizing the danger of an outbreak TSN creates funding for the issue of live stock diseases. This demonstrates actors can use the opening of the policy window very successfully for their own cause.

Chapter 10

A Tale of Two Cities

10.1 INTRODUCTION

In the Dutch municipalities of Helmond and Tilburg plans were made to so some redevelopment of the urban center. An e-government application was used to promote participation in the plans. An application was created, named Virtuocity, in which the citizens could access the cities virtually and be informed and participate in the policy design process. The application Virtuocity is a GIS and used as such. In Virtuocity citizens can walk through the virtual world in which the building plans were already executed. In Tilburg they could even vote for different designs of a square.

In both cases there was a need for policy regarding the new urban center of Tilburg and Helmond. The policy design process focused on what the different alternatives could be for the final design of the new urban center.

In this chapter the case of Virtuocity will be looked at in order to understand the perceived influence of GIS on policy design. This chapter forms the fourth of a series of six case studies which will bring us further in answering the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and theÛ outcome of processes of agenda-setting and policy design?". Where the former three chapters initially dealt with agenda-setting this chapter will initially deal with policy design.

In order to do so first in section 10.2 it will be explained what Virtuocity is and what citizens could do with it online. Also it will be discussed how Virtuocity was designed and implemented and what the outcome of these processes were. In section 10.3 Virtuocity will be looked at for an influence of GIS on policy design. This will be done by analyzing the application for the enhancing qualities and effects described in chapter 2. Next in section 10.4 the more indirect perceived influence of GIS on policy design will be looked at, by using the conceptual framework of policy design. First its building blocks will be looked at and finally the conceptual framework itself will be dealt with, as described in chapter 6. It will become apparent that in the case of Virtuocity, just as in the cases for agenda-setting a second arena emerges. In the first arena the policy design for the urban center of both cities is made but in this second arena this is not the subject. Here actors aim to design policy on the application of Virtuocity itself. This deals with the functions of the application and how it is implemented. This arena will be treated as an arena of policy design as described in chapter 6. First the building blocks of the conceptual framework of policy design will be dealt with and finally the conceptual framework as a whole. In the end a conclusion will be given with an overview of the perceived influence of GIS on and policy design in the case of Virtuocity.

10.2 VIRTUOCITY

Two Dutch cities, Tilburg and Helmond, wanted to do some redevelopment of their urban center. They chose not to do this in the conventional way but they wanted to use the Internet and interactive technology to inform and include citizens in this new redevelopment. In order to do so they both implemented an application named Virtuocity. The city of Helmond is located in the south of the Netherlands and holds approximately 87.700 inhabitants, Tilburg is located in the south as well and approximately 203.500 citizens live there.

In this section first the features of Virtuocity in both cities will be discussed, secondly the process of implementation will be described and finally the outcome of this process in both cities will be elaborated on.

10.2.1 Features of Virtuocity

When looking at Virtuocity as an application one needs to distinguish between the features that were incorporated in Helmond and those incorporated in Tilburg. Therefore both cities will be dealt with separately.

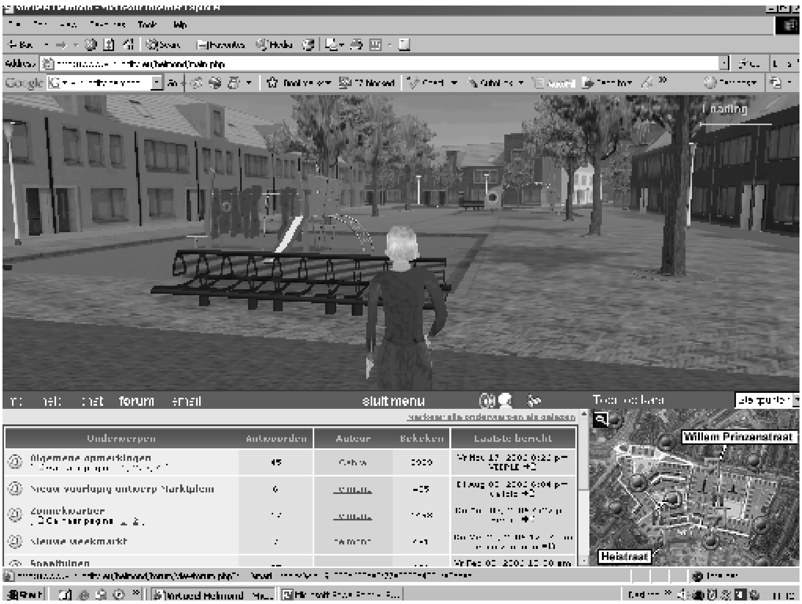

Figure 10.1: Virtuocity in Helmond with Forum

Helmond

In 2004 the Dutch municipality of Helmond decided to do some urban redevelopment. They wanted, being part of the program 'Kenniswijk' (Knowledge neighborhood) to do so in a non-conventional fashion. 'Kenniswijk' is run by the Ministry of Economic Affairs, in this program people get the opportunity to engage in innovative projects and services in the field of computers, communication and Internet to experiment. In this way the Dutch government wants to examine which social and economic effects will occur in the areas Kenniswijk was launched. The hope is the areas in which Kenniswijk was launched will be two years ahead of other areas in the Netherlands so a consumer market of the future will arise.

In Helmond it was decided to launch a website running an application named 'Virtuocity' designed by CEBRA, a company which expertise lies in virtual multi-user worlds. This website was to be accessible for everybody with a personal computer with Windows and an Internet connection from their own home or any other location.

In Virtuocity the plans for the new urban center were visualized in a three-dimensional environment, which looks like most computer games. One area of the city, initially, was chosen to be viewed on this website and the buildings which were to be built were shown as three dimensional buildings. First citizens had to download the application on their own computer and next they were able to log on the website without registration and could just pick a user name each time they accessed. Next they were allowed to choose an

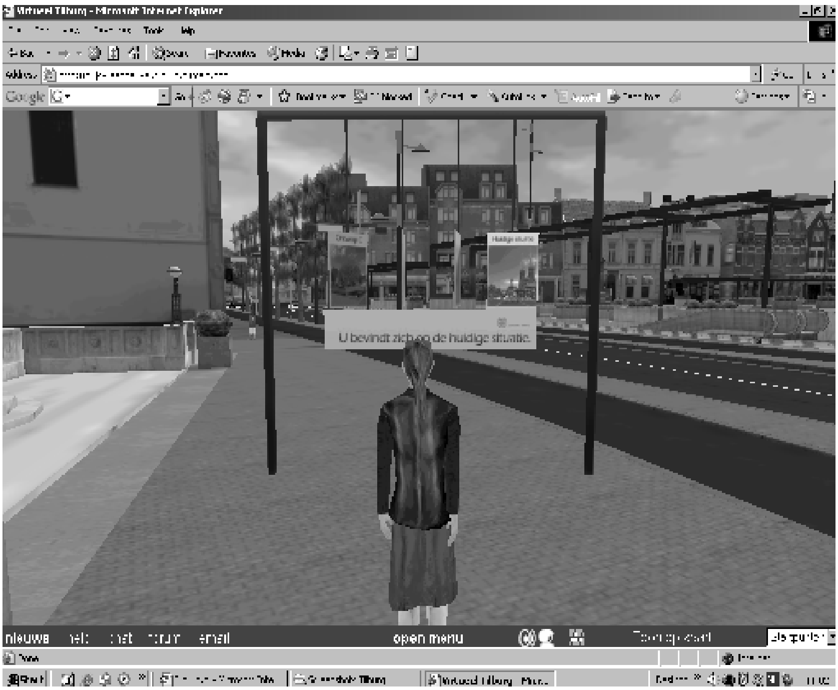

Figure 10.2 Virtuocity in Tilburg, Choosing One of the Three Designs

avatar and actually walk through the new virtual city of Helmond. On a small map in the screen one could see his location within Helmond and on the larger screen one could walk or run through the city as if in a gaming situation. It was, for instance, possible for citizens who actually lived in the area to stand in front of their own house and see how their new street would look. It was also possible to walk the route children would walk going to school and see if any new, possibly dangerous situations occurred. Next to informative the site eventually proved to be entertaining for citizens.

But the application Virtuocity had more features than visualization alone. Through a forum it was possible to read and write on the urban redevelopment plans. The municipality itself put information on the forum and asked people to react to this, technical messages were also displayed. Citizens could also open their own topic and discuss the new urban center, put their complaints forward, show their appreciation or ask the local government a question. A chat was included in the application, here citizens could chat with each other, and discuss the redevelopment. At set times there were chat sessions with aldermen from the municipality of Helmond in which citizens were able to voice their complaints, their criticism, their appreciation and in which questions could be answered.

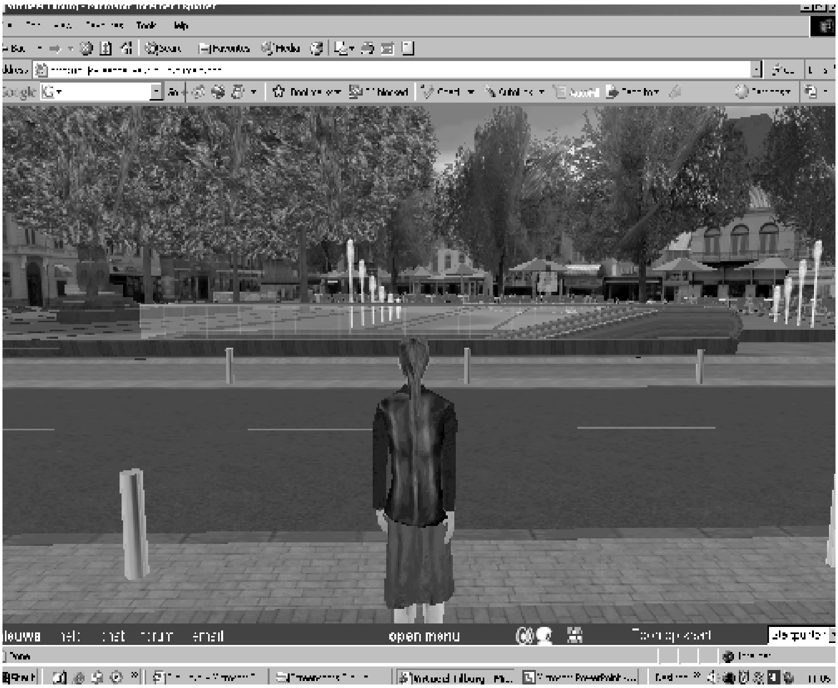

Figure 10.3: One of the Designs in Tilburg (The Winning Design)

Finally Virtuocity included a poll. This poll dealt with a playground that still had to be built; this playground was visualized in the application so people could walk around it and actually slide down the slide. Citizens were asked for their opinion on how the playground was supposed to turn out in their opinion. They could choose between three different options on the material used for the playground, metal, wood or plastic type materials.

Figure 10.4: Virtuocity in Tilburg with the News and the Map

Tilburg

In 2006 the Dutch municipality of Tilburg used Virtuocity as well, designed by CEBRA. The city of Tilburg was also planning to do some redevelopment of the urban center but contrary to the situation in Helmond, Tilburg wanted citizens to be able to vote for the design they wanted in their city. This was done at a square in the center of Tilburg named ‘de Heuvel’. In Virtuocity, similar as in Helmond citizens were able to access Virtuocity online from their own home. Provided they had an Internet connection and a personal computer running on Windows. They could download the application on their own computer and log on without any registration, choose an avatar and walk over the Heuvel and the surrounding area. As in Helmond, a forum and a chat were also available.

What makes Tilburg different from Helmond was the voting. In Virtuocity the current design of de Heuvel was visualized, but also three different designs. Citizens could walk their avatar towards the ‘voting point’ in front of the church and there they could choose which design they would want to see and experience; the existing design or one of the three potential designs. If one would want to walk around one of the potential designs one would just click the link and the Heuvel would transform into the design of ones choice. In this way citizens were able to walk through all three potential designs. Finally one could make a choice for the design one preferred. The city council committed itself to have the design with the most votes built.

10.2.2 The Process of Implementation

The process of implementation of Virtuocity differs between Helmond and Tilburg as well; therefore here as well the distinction between the two cities will be made.

Helmond

Since implementing Virtuocity proved fairly expensive, the municipality of Helmond did this together with other partners like building cooperations, owners of property and project designers. Additionally Helmond could afford to do so by being part of the program 'Kenniswijk'.

At first the city hesitated to implement Virtuocity, they feared citizens would start protesting against every new building which was to be built. This fear was rooted in the idea that in the virtual environment plans became so clear and detailed there could be a lot to complain about. When the decision finally fell to implement Virtuocity the city had made sure the site could be accessed by as many people as possible even by people with older computers. Additionally the application had to be simple and easy to use in order to include people with poor computer skills. Together with CEBRA the design was made and the plans for the redevelopment were included in the design. CEBRA installed a helpdesk so people who had problems with downloading or using the application could obtain help. In community centers and libraries computers were installed so people who did not own a computer could still use Virtuocity.

Before launching the application a test panel was constituted of several citizens of Helmond so the municipality together with CEBRA could check where possible problems may lie or what to expect regarding the appreciation of citizens. The test panel proved to be very positive but had two remarks; firstly they wanted the avatar to be controlled by more possibilities than just the mouse. Therefore CEBRA made it possible to also use the keys on the keyboard to move the avatar. Secondly the panel had the opinion that the application was a little dull and static, nothing moved and it looked a little pale. CEBRA therefore included driving cars on the roads, pigeons on the squares and church bell sounds. The test panel was very positive on the visualization capabilities of the Virtuocity, the forum and the chat. It was their opinion that the application was easy to use and that it would account for better information and communication means than conventional ways to deal with urban redevelopment. Virtuocity was ready to be launched.

Helmond promoted Virtuocity by informing people through the local media. After implementing Virtuocity three more areas of Helmond were included in the virtual space so people were able to see more of the city. New plans were placed on the site as soon as possible so the site stayed up–to-date. There were some plans to include an actual voting on the new shopping mall but this plan failed. When in the city of Helmond these plans were initiated there was the fear that people would vote for a design of which the city itself would disapprove. The plan already died before reaching the city council. Another reason for the plan to fail was that the city had no decent idea of how to handle these kinds of initiatives.

Tilburg

At first Tilburg planned to use Virtuocity in the same way as Helmond did. They wanted to do so for a square named 'Pietervreedeplein'. This project failed to be executed. The design was already made to its finest details so a forum and a chat were not very useful since citizens' opinions could not be taken into account. Three months later the idea for using Virtuocity for the redevelopment of de Heuvel came up. The municipality already decided that in the redevelopment of de Heuvel they wanted citizens to participate, but not necessarily digital. Using Virtuocity and digital citizen participation became the plan.

The plan included first a competition. Citizens of Tilburg could, in writing, send in their ideas of how de Heuvel should look; this could be through a map, a poem, a drawing or a story. There turned out to be 323 pieces handed in. On the basis of what people wanted criteria were made. It turned out that people wanted the Heuvel to be a square with a lot of green, places to sit and organic material. After this phase, phase two started, eight architects were asked to design the Heuvel matching the criteria stated after the competition. The city of Tilburg feared some of the designs would be impossible to build or would not match the legal criteria for building. Therefore these designs were looked at by a jury of experts. The jury of experts excluded the designs which were technically or legally impossible or difficult. From the remaining designs three designs were chosen on the basis of them being innovative and exciting. Also the three designs had to differ significantly from each other. These three designs were the designs in the race of becoming the new Heuvel.

Before Virtuocity and the voting could be implemented there were some questions to answer for the municipality of Tilburg. The first question was whether to make the voting solely digital or to have conventional paper ballots as well. After some debate the city decided to only make voting possible digitally. This was decided because they felt a lot of people would vote and including paper ballots would hinder the innovative character of the idea. Because of this a formal referendum became impossible since it was arguable that not all people own a computer or have the computer skills needed. Also there was a fear the opposition in the council would complain about the vote not being representative, while only voting through means of the internet was possible. Next there was the question of a minimum number of votes before the council would execute the new design. Plans were made to have a minimum number of votes but later on this plan was changed and the winning design would be the design chosen, regardless of the number of votes. Third the question of fraud came up. Since, like in Helmond everybody with an Internet connection was able to access the application and could thus vote, and even more than once, the question of fraud was difficult. Similar to Helmond the city decided that by making a registration procedure citizens would be less willing to access Virtuocity. CEBRA committed itself to checking IP addresses and the addresses which were not in the Tilburg area would be excluded from the vote as well as the votes made more than once from the same IP address. The final question that needed to be resolved was a disagreement between the city of Tilburg and CEBRA. Tilburg initially did not want a chat and a forum in the application; they did not see the added value since they regarded Virtuocity as a voting tool. CEBRA insisted that Virtuocity was next to a device to visualize also a device to communicate. CEBRA got its way and the forum and the chat were included.

After dealing with these matters Virtuocity finally could be implemented. First the city made a lot of promotion for the plan; there were advertisements on the radio, the local television and the local newspaper and in the town itself flyers were handed out to shopping citizens. Similar to Helmond there were computers placed in public places where people could vote who did not own a computer or did not have the proper computer skills. A test panel here was not used since Helmond had done this already. The architects designs were placed on the site and the voting could begin.

10.2.3 The Outcome of the Process of Implementation

As for the implementation of Virtuocity the outcome of this process shows remarkable differences between Tilburg and Helmond. First Helmond will be dealt with and later on Tilburg.

Helmond

According to respondents, Virtuocity in Helmond proved to be a large success in both the opinion of the government, CEBRA and of citizens. Respondent claim people felt taken seriously by their government, and appreciated very much that their opinion was taken into account. In the end there were less complaints and less critique from the side of citizens than in any other redevelopment plan done by the municipality of Helmond. The city of Helmond believes that this is the case because people mostly file complaints because they are insecure about the plans. In conventional ways of demonstrating plans to citizens they can only see the plan once, during a meeting. By using Virtuocity people are able to look at the plans as often as they please. Additionally the gaming situation is much easier to understand than a maquette or a sketch. Therefore people felt much more informed and were thus less likely to file complaints. The application was and is visited very frequently by citizens and no complaints of accessibility were heard.

The forum proved to be a great success as well, in the beginning approximately 60 people each day accessed the forum, a year after launching this stabilized to about thirty to forty visits each day. According to respondents people felt that they were allowed to give their opinion and that the local government actually listened to them. Just after a few days the forum as well as the chat turned from just a place to get information to a social gathering space in which people could communicate with each other and with their local government. This in the opinion of the municipality as well as of the citizens served as a bridge between government and citizen, a two-way stream of communication. The chat sessions with aldermen were visited by a large number of citizens. In the opinion of citizens this provided for an easy, simple way to be heard from their own homes. Citizens felt the information on the site was up to date and very clear.

The poll worked out very well, a lot of people cast their opinion and the city took them into account. Since the opinions in the poll were so equally dispersed among the three options the city decided not to pick any of the options but to design a playground taking all the materials into account, a mix so to speak.

The cooperation between the local government and CEBRA worked very positively according to both parties, the government claims CEBRA helped out with all technical problems and the helpdesk was very useful.

Genuine e-democracy in the opinion of the city is not yet possible. The plan to vote for the shopping mall failed, this because public administration is not ready for these kinds of risks, according to the city itself. It is the city's opinion that Virtuocity made communication with citizens much easier since plans are more appropriately visualized they can be made clear without any ambiguity of the intention of the plan. Policy becomes more transparent which in the city's viewpoint makes communication easier. Citizens again feel more involved, can actually participate en feel taken seriously. Plans for expanding the application in Helmond are being made and welcomed very much by the local government as well as citizens.

Tilburg

At the end of the period Virtuocity was online in the city of Tilburg there were over 4000 votes casted and over 115.000 visits to the site. Reactions in general were positive. One of the designs won with over half of the votes. After the more detailed sketches are made for the design the council will, as they committed themselves to, follow the opinion of the citizens of Tilburg. Reactions of the public were very mixed. In general there existed a large group of citizens who felt taken seriously and felt their opinion was taken into account. They felt that the gap between citizens and government had reduced. Another smaller group of citizens did not feel taken seriously at all. Their main point of concern was that in their opinion the city already made a decision and the voting was a farce. In all three the designs there was a large road around de Heuvel which some people did not approve of, they where upset that they had not had the choice for a design without this road.

Where in Helmond there was no critique found in the city council itself in Tilburg the case was different. One of the smaller parties, the LST (Lijst Smulders Tilburg) in the council had fierce criticism on a number of points. Main point of concern was the issue of the road. Secondly there was a critique on the way the designs were selected; the aldermen picked the three designs from the designs which made it through the jury of experts on the basis of being innovative. The party felt that it was not for the alderman to judge whether citizens want a new innovative square. Thirdly there was the question of exclusion. This critique was not only limited to the party but was also heard from citizens. People with poor computer skills or people who did not own a computer running on Windows could only access the site when they would go to one of the public computers. Therefore people as well as the party felt that a large group of people was excluded in the process. In general the party considered the voting not to be democratic at all and the entire idea a farce. The aldermen of the city of Tilburg looked upon this critique as just being a critique from a deviant opposition party. However the critique the party voiced was congruent with the opinion of a fair deal of the population of Tilburg.

The forum as well as the chat, for the citizens who were positive about the plan of voting worked out very well. There were a number of comments on how clear the application visualized the new designs, for them this was a lot clearer than a sketch or a maquette. On the forum as well as on the chat people motivated their choice for a design and explained why they believed the other designs should not be chosen. Like in Helmond the virtual environment changed from a space to visualize the new plans to a virtual gathering place. It must be mentioned that on the forum the communication between citizens and government was minimal, it were mostly citizens debating with each other on the different designs.

The cooperation with CEBRA moved less smoothly as in Helmond. Firstly the issue came up whether the chat and the forum should be included, CEBRA insisted to do so since Virtuocity, in their opinion, is not only a means for visualization but also for communication. The city did not wish to do so but eventually gave in. Despite the criticism from citizens, both CEBRA and the city felt that with an application running on Windows enough was done to ensure the use of the site for as many people as possible. Virtuocity in Tilburg was a lot larger than in Helmond, there were a lot of complaints from people with older computers who could not run the application or who believed the application loaded too slowly. Both CEBRA and the city of Tilburg believed this to be a complaint from only few people. Another clash occurred as well between CEBRA and Tilburg, this on the point of priorities on the application. CEBRA wanted the application to be technically state of the art, a high resolution so the designs could be viewed in full detail, the city placed its priorities elsewhere, namely in the point of accessibility. A high resolution would make the application load slower and for people with older computers maybe even impossible to access. A middle ground was found.

The three architects making the final designs also had their say. The general mood was that this was an interesting development and that they enjoyed promoting their design this way. They claimed that the only downfall was that in a conventional presentation of the design they were able to show the listeners their vision, to guide them through the design. Now they were not able to do so. Regarding the process of the implementation there was fierce critique. Architects were very upset that they were not able to see the designs after the jury of experts judged them, they were put on the site and there was no time anymore to correct or adjust points. One of the architects tried to sue the city of Tilburg for putting her design on the site but not representing it the way she planned. It is interesting to note that the architect of the winning design engaged the most in Virtuocity himself, he actually walked around the Heuvel and invited people to chat with him, as a usersname above his avatar he even chose: 'Vote for design C'.

All in all, even though a lot of critique was heard Virtuocity in Tilburg was a success. According to respondents a lot of citizens felt more involved and felt taken seriously in their opinion by the government. They feel Virtuocity accounts for an experience and that plans are a lot easier to understand. The city feels though that society is not ready for this kind of e-democracy, conventional paper ballots are still needed next to a digital possibility.

10.2.4 Helmond and Tilburg Compared

After describing the features of Virtuocity in Helmond as well as in Tilburg and elaborating on the implementation processes and outcomes, for the sake of clarity here an overview will be given of the comparisons and differences between the two cases.

The most striking difference in terms of features of the application is first of all the fact that in Tilburg Virtuocity was used for the purpose of voting, and the vote was binding. In Helmond this was not the case. Secondly a difference is that in Helmond the local government responded to answers on the forum and organized chats with alderman, while in Tilburg the communication on the forum was mostly between citizens.

In general it can be said that for both cases the local governments as well as a large proportion of citizens were very positive. According to respondents citizens felt taken seriously and felt the government took their opinion into account. Citizens held the opinion that Virtuocity made plans a lot clearer and that they were able to really understand what was happening to their town. The local government of Helmond believes that citizens are far more willing to accept the hinder of building in their city as long as they know exactly what is going to be built. In both councils there was little critique and both local governments consider the project to be a large success.

However there was critique as well. In the first place the critique of citizens, in Helmond there was no critique to be found where in Tilburg people complained about not being able to run the application, the application moving too slowly and the fact that they had to download something on their computer. Some people also believed the voting was a farce and that the local government made their mind up already. People were angry they did not have the chance to vote whether they were in favour of the large road around the square. A reason for this discrepancy could be found in the fact that in Helmond there was no actual vote, people could give their opinion but the local government decided in the end. Questions of exclusion were therefore not as significant to people as in Tilburg. The critique the local government would decide in the end anyway is not applicable in Helmond since the city already admitted that they would. Where Virtuocity in Tilburg was a means for voting, in Helmond it was a means of transparency and communication.

Secondly a large difference is seen on the forum. Communication between citizens is seen on both forums but communication between citizens and governments occurred to a far larger degree in Helmond than in Tilburg. People on the forum asked questions and later obtained answers. The local government of Helmond also posted topics on the forum where the city of Tilburg did this to a much lesser degree. Again this can be explained by the fact that Virtuocity in Helmond served as a means of transparency and communication, therefore there was a lot of attention for the communication between citizens and government. In Tilburg people could cast their vote so they did not have to debate with the government on how they liked a design. Where in Helmond the communication had a two-way character in Tilburg the character of communication seemed to be more of a one-way street.

In terms of the implementation of the application there is a slight difference to be found. In Helmond the city was more laid-back and just solved the problems where they turned up. The problem of fraud was addressed but was not a mayor issue. Before launching the application there were not a lot of urgent questions which needed to be addressed. In Tilburg the case was different, there were a lot of questions, fraud, accessibility, whether to have a forum, exclusion, representativeness and so further. Again the explanation can be found in the voting situation, Tilburg feared the opposition in the council would consider the vote illegitimate since the means were not accessible to all.

The start of the process was also different. Helmond wanted to do something with digital government and chose the urban redevelopment as its case. Tilburg wanted to vote on de Heuvel and decided later that a digital means would be used for this.

Finally it must be mentioned that both cities implemented the application through different departments, Tilburg through informatization and Helmond through communication. This seems to matter, in Helmond there was a lot of attention in informing citizens on what the application actually entailed and what citizens could expect, communication was very important. In Tilburg the emphasis was more on the technical aspects of the application and communication was not the most important issue. Additionally Tilburg did not inform citizens of what to expect.

10.3 GEOGRAPHICAL INFORMATION SYSTEMS IN VIRTUOCITY

After looking at what actually went on in the cities of Tilburg and Helmond when implementing Virtuocity and what the outcome of this process was, it is now time to look at what the meaning of GIS in Virtuocity is. The qualities and effects of GIS as described in chapter 2 will be looked at and analyzed in the case of Virtuocity in two cities.

GIS are said to hold a quality of integration and calculation (Bekkers & Moody, 2006; Lips et al., 2000, Bekkers et al. 2005; Hout & Bekkers, 1998; Greene, 2000). This does not hold up in the case of Virtuocity, no different databases are integrated by GIS, these data were already integrated before the use of GIS, furthermore no calculation was done by using Virtuocity. What is to be found, to a very large degree is the quality of visualization (Bekkers et al., 2005; Hamilton, 1996; Greene, 2000). In both cities of Helmond and Tilburg the power of Virtuocity, according to its users and designers, lies in the power to visualize. Since Virtuocity makes it possible to walk through both cities in a virtual world, it became very easy to understand what the potential new plans entailed. A maquette could never have given citizens this experience.

In terms of effects GIS are said to have communication comes forward first (Bekkers et al. 2005; Bekkers & Moody, 2006; Haque, 1996). A distinction must be made between the use of Virtuocity in Helmond and in Tilburg. In Helmond communication has improved significantly. Not only do citizens discuss the plans online with each other but also the communication between the local government and citizens improved. Citizens placed their questions and concerns on the forum and the local government made sure to answer quickly. The chat sessions also accounted for a feeling on the side of citizens of being taken seriously and a partner in decisions on their city. In Tilburg however, not all citizens had this feeling. They felt that plans were communicated to them in a better way compared to a maquette, by the visualization function of GIS, but they did not feel the application also made communication between citizens and the local government move more smoothly.

A second effect of GIS which can also be found in Virtuocity is transparency (Bekkers et al. 2005; Carver et al., 2000; Moukomia, 2004; Overchuk, 2004). In previous cases it can be found that GIS has the power to make the work process more transparent, in Virtuocity this was not the case since no data and no organizations have been integrated. What did become more transparent are the plans for urban redevelopment. Because of the use of Virtuocity the plans became clearer, since a real life experience is better to understand than a sketch or a maquette. Furthermore, the plans did not only become clearer, but also clearer to many people, since Virtuocity was broadcasted online.

10.4 VIRTUOCITY AND POLICY DESIGN

Above is demonstrated how the use of GIS can enhance the process of policy design in the case of Virtuocity. Another influence can be found as well, therefore in this section the conceptual framework of policy design will be used to analyze the case of Virtuocity in Tilburg and Helmond. It must be noted this section will deal with the policy design process of the urban redevelopment. First the building blocks of this framework, the variables taken out of the existing models, constituting the conceptual framework of policy design, must be addressed. After that the conceptual framework itself will be used to analyze the Virtuocity case.

10.4.1 Concepts of Policy Design

Before moving on to the actual framework of policy design first the building blocks of the framework, the variables taken out of the existing models constituting the conceptual framework of policy design must be addressed. First bounded rationality will be dealt with, secondly satisficing, conflicts of values and power, fifthly formal institutional features, next the rules in use and finally culture.

Bounded Rationality

The bounds in rationality described by Simon and others (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968) are clearly to be seen in the process of policy design in both cases. The bounds in rationality hold that humans cannot behave completely rational and that they are not able to list all consequences of each possible policy alternative.

The prime point where this can be seen is on the side of citizens. While citizens formerly were not able to understand plans for redevelopment it becomes clear that with the visualization function of Virtuocity that the plans became understandable. The skills needed to read a maquette or a sketch were no longer needed. The three-dimensional environment made it easy for citizens to grasp what was going on and understand the consequences.

Additionally both local governments were now able to be informed on what citizens actually thought about plans. They could read back on the forum to gain a clear understanding on how citizens felt about the proposed plans.

Satisficing

The concept of satisficing instead of optimizing can be found as well. Satisficing holds that a sub-optimal policy alternative is chosen since time, resources and rationality are lacking. Without these there is no time or knowledge to look for an optimal solution, so policy-makers will settle for a solution which is good enough (March, 1994).

First of all this becomes clear in Helmond where the local government had to adapt plans to the wishes of citizens while they themselves would have preferred to see plans differently. On the other hand, citizens did not always agree with the option provided by the local government. The final design thus came about by consensus and was not optimal for either group of actors.

In Tilburg the same happened but in a different manner. A formal referendum was not possible and fraud could not be fully prevented in the voting. The final design of de Heuvel was therefore not, in the governments' opinion, the design they wanted since the process did not occur in an optimal matter. Citizens were in general not pleased with any of the three designs, with each design there was a flaw. They did vote for one of the three alternatives but settled for the alternative they disliked least. Optimality was therefore not the case here.

Conflict of Values

In terms of conflict in values a few instances can be found in the case of Virtuocity. These conflict in values are important since the outcome of these conflicts influence the final policy design (Etzioni, 1967).

Remarkable enough in the city of Helmond no conflicts are found within the policy design process for the new urban center. The case in Tilburg however, is different. The main conflict, which comes forward in several smaller conflicts deals with the level of autonomy of citizens and governments, in how much influence they have had. Here while a group of citizens feels taken seriously another group holds the opinion that Virtuocity is only used to enforce an idea upon them and that democratization is definitely not the case at all. The reason for this is threefold. Firstly because in all three designs of the square the road was present, so a vote for a design without the large road was impossible. Secondly some citizens did not appreciate any of the designs and they felt like they were forced to choose for the 'lesser evil'. Finally citizens felt that they were not taken seriously because the government of Tilburg was not present on the forum, questions remained unanswered while citizens had assumed the forum was a two way street.

Power

Power is linked to the conflict in values, while in the conceptual framework of policy design the perceived, relative amount of power of one actor, as perceived by other actors, can determine how the final policy design would look (Etzioni, 1967; Dahl, 1961).

Even though in Helmond there was no conflict to be found, citizens gained in relative power. They were more informed than they were priorly because now they could understand what was going to happen; furthermore they had the opportunity to communicate with their government in a more informal manner. The government of Helmond accepted this shift in power and actually welcomed it; this might explain the absence of conflict.

In Tilburg the shift of power from the local government towards citizens at first glance seems larger than in Helmond, since in Tilburg citizens could actually vote for a plan. In the eyes of citizens this is not the case. Citizens in Tilburg do not feel empowered and feel like most of the power remains with the government since their options to choose from are limited and since a proportion of the citizens is excluded. This emphasizes what the reinforcement thesis claims, that those in power are only strengthened by the technology use (Kraemer & King, 1986).

However it must be said that while Virtuocity may strengthen the government there is some power that floats towards citizens while they have an easy access way to voice their opinion. Citizens in both cases gained power compared to conventional ways of urban redevelopment.

Formal Institutional Features

The fourth building block of the conceptual framework of policy design is the formal institutional features. These are important because the formal rules, laws and organizations partly determine what is possible in terms of policy alternatives (Ostrom et al., 1994).

In the policy design process of both urban centers these formal institutions are important, one cannot just build anything in any place one pleases. Therefore in Tilburg some of the designs of architects were excluded from voting by the jury of experts. In Helmond not all citizens' wishes could be granted. This did not cause a lot of problems since these rules on planning have existed for a long time and citizens and governments are aware of these boundaries.

Rules in Use

The second structural building block is the rules in use; these are the informal rules which determine to a large degree the course of interaction in the policy design process (Ostrom et al., 1994; Stone, 1997).

In the case of Virtuocity the rules in use are very important; because of Virtuocity the old rules in use on urban planning were dropped. The old rules included informing citizens on the plans and if a citizen had objections they could file a complaint. The new rules require citizens to actively participate as a partner in the redevelopment. In Tilburg this is seen through the voting, in Helmond through communication with the local government. Put shortly, the rules of interactive policy-making come into place here. A reason for this is that it is said to close the gap between government and citizen. It creates acceptance for certain policy proposals and finally it enlarges the quality of policy because the proposal can be looked at from different angles. With this interactive policy design there are some features that are most important, firstly openness, which means all groups must be able to participate. Secondly there must be equality of different groups of actors. Thirdly dialogue must proceed in a reasonable fashion. Fourthly everybody should have that opportunity to exert influence in the matter and finally communication must proceed through different channels (Bekkers et. al., 2003). It becomes clear here that GIS and thus Virtuocity did demonstrate a large potential for interactive policy design. GIS and Virtuocity show communication can proceed through different channels, not only did it constitute for a virtual meeting place but also for a presentation of plans independent of place and time (Kingston et. al., 2000).

Culture

The final building block is culture; this refers to the national mood and the values acceptable in a society (Ostrom et al., 1994).

In designing the new urban center in Helmond as well as Tilburg two things can be mentioned regarding culture. Firstly, according to respondents and forum hits, citizens do want to participate in the redevelopment of their city. With Virtuocity a number of citizens feel taken seriously. Virtuocity was able to demonstrate to people what the exact plan was going to be, for this reason, according to both local governments, and there were fewer complaints on the actual building plan than usual. However in Tilburg there existed a lot of mistrust towards the motives of the government to implement Virtuocity, and citizens felt like the vote was a farce.

Secondly a culture in both cities can be found on the side of the local governments of wanting citizens to participate with the purpose of closing the gap between citizens and government.

Summarizing this it becomes clear that on redesigning the urban center of both Helmond and Tilburg the bounds in rationality have decreased on the side of citizens, since they understand plans better since Virtuocity. On the side of the government these bounds have also decreased since now they know how citizens feel. Both in Helmond and in Tilburg a satisficing solution was chosen on several occasions. In Helmond this was more of a consensus between government and citizens and in Tilburg this can mostly be found in the question whether the vote was representative. Furthermore it is found that in Helmond no major conflict has occurred and that power shifted towards citizens. In Tilburg there were more conflicts due to the fact that citizens did not feel taken seriously and the choices to vote for were limited. Citizens in Tilburg did not feel empowered and felt like Virtuocity strengthened the power of the local government. The formal institutions have not helped or hindered in both cities. The regulations on building were clear in advance. Through Virtuocity the rules in use have changed, moving more towards interactive policy-making, due to the functions of Virtuocity. Finally culture shows that citizens do want to participate in developing their own urban center and governments are willing to let them do so.

10.4.2 The Influence of Virtuocity on Policy Design

After looking at the variables making up the conceptual framework of policy design, and referring them to Virtuocity in both cities now the conceptual framework of policy design can be used to analyze the case of Virtuocity. As outlined in chapter 6 the conceptual framework of policy design consists of three parts and four channels of interaction.

The first part of the conceptual framework of policy design deals with the action arena (Ostrom et al., 1994). This is the space in which all involved parties interact. There are several groups of actors in the process of making policy for the new urban center in both cities. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

The actors in the action arena are the local governments, since they decide on the final implementation, citizens of both cities, since they interact in this process and CEBRA as the designer of Virtuocity. In the city of Tilburg also the architects are included as actors since they designed the different alternatives for the urban center.

The second part of the conceptual framework of policy design is the technology, Virtuocity in this case. This deals with the features of the technology itself but also how actors perceive this technology. What is interesting here is that closure on the meaning of technology has occurred in Helmond but not in Tilburg. This means that in Helmond all actors agree on what Virtuocity is and how it should be used, in Tilburg this is not the case. This closure on the meaning of technology in Helmond means that all actors agree that Virtuocity should be perceived as a tool for visualization and communication, giving citizens power over their urban center. In Tilburg closure on the meaning of technology does not occur since the local government views Virtuocity as a tool for providing information, a voting device, while citizens view it as a communication device. Furthermore the local government feels Virtuocity will give citizens power while some citizens believe Virtuocity will only enforce the government's power.

The final part of the conceptual framework is structure; this includes the formal institutional features, the rules in use and culture (Ostrom et al., 1994). For the formal institutions it can be said they influenced the action arena in the way that not everything is possible in terms of building. The scope of the building alternatives are limited by law, therefore all actors were bound to this law and could not just build or ask for any alternative. Secondly the rules in use are important. They accounted for a situation in which interactive policy-making became the norm. This was more the case in Helmond, where citizens became partners, than in Tilburg where they could vote. This did give citizens a lot of new power, even though in Tilburg not all citizens felt it that way. Finally culture influences the action arena in terms of wanting to participate on the side of citizens and wanting citizens to participate on the side of government. This also made sure that in the action arena citizens gained power and participated in fairly large numbers, especially in Helmond.

As stated the conceptual framework of policy design consists of four channels, next to the three parts described above.

The first channel moves from structure to the action arena, influencing the actions in the action arena and determining the scope of actions possible. This channel functions as described above.

The second channel moves from the action arena towards technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artifact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992). It is important here to make a distinction between Helmond and Tilburg. In Helmond closure on the meaning of technology existed fairly quickly. Both government and citizens agreed that Virtuocity was a tool for communication, visualization and transparency and they also agreed that this tool would give citizens the possibility to be a partner in the designing of a new urban center. In Tilburg however this was not the case, closure on the meaning of technology did not exist. There was debate on what Virtuocity was, the government considered it a tool for transparency, giving citizens information on what they could vote for. But citizens and CEBRA also regarded Virtuocity as a tool for communication. When the government did not communicate on the forum citizens felt disappointed and not taken seriously. Secondly there was another debate, a debate between the local government and citizens who felt Virtuocity and the voting were a farce. Here it becomes clear the local government considers Virtuocity to be an application to empower citizens and to close the gap between governments and citizens. Some citizens believed they were lied to and it did not give them any power at all since they could not really voice their opinion.

This brings us to the third channel, the channel moving from technology back to the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992). Since Virtuocity has been shaped differently in Helmond than it has in Tilburg here again a distinction is needed. In Helmond closure on the meaning of technology had occurred so all actors view Virtuocity in the same way. This made sure that in Helmond the government communicated with citizens and made sure to answer questions quickly and to react to complaints appropriately. Because of the rules of interactive policy-making ideas of citizens were taken into account and citizens were very happy with the way this proceeded. All together it can be said that in Helmond through this channel cooperation in the action arena moved very smoothly. In Tilburg this cooperation was more difficult. Closure on the meaning of technology had not occurred; not all agreed on the meaning of the technology. Citizens were disappointed with the lack of communication of the government and some citizens felt cheated. This accounted for distrust between actors and this made sure that conflict occurred on a more regular basis than in Helmond.

Finally there is the channel from technology to structure, after the actors in the action arena have shaped technology and closure on the meaning of technology occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). This can be found in the case of Virtuocity. In both Helmond and Tilburg, even though closure on the meaning of technology did not occur there, the rules in use changed by Virtuocity. The new rules in use became the rules of interactive policy-making. Furthermore the culture of wanting to participate has become stronger which can be found in the Virtuocity application in Helmond which still exists.

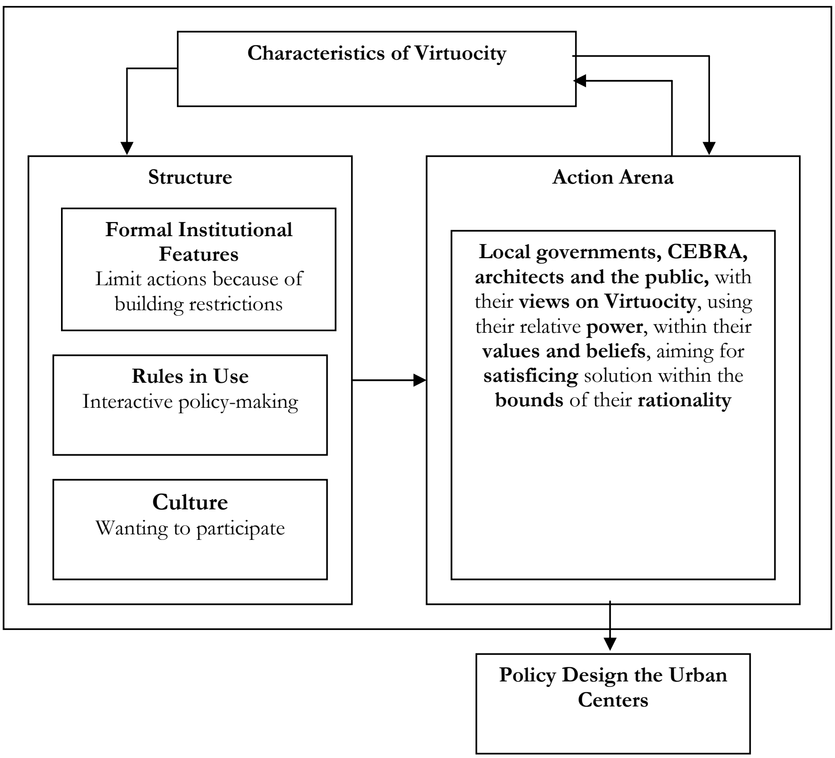

Figure 10.5: The Conceptual Framework of Policy Design

10.5 THE SECOND ARENA, DESIGNING VIRTUOCITY

As in the cases for agenda-setting, in the case of Virtuocity a second arena emerges. The first arena dealt with designing policy on the urban center but this second arena deals with policy design on Virtuocity itself, how it should be implemented and what the application should be able to do. Again a number of actors try to push their idea forward and try to make sure the application will look like they prefer it (Markus, 1983; Goodhue et al., 1994). In the following section this arena will be discussed.

10.5.1 Designing Virtuocity and Policy Design

Before moving to the conceptual framework of policy design, like above, first the variables taken out of the existing models, the building blocks of the conceptual framework of policy design, will be discussed. First bounded rationality must be dealt with, secondly satisficing, thirdly conflicting values, fourthly power, fifthly formal institutional features, sixthly rules in use and finally culture.

Bounded Rationality

Starting with the bounds in rationality, which hold the bounds in human capacity to be able to list all the possible alternatives and their consequences to a policy problem (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968).

It can be found that in the second arena, the arena in which the application Virtuocity was designed, these bounds only increase, contrary to the first arena.

This can be found on the side of governments, since citizens did not take part in designing Virtuocity. Both local governments were in the dark on what the costs and benefits would be. The reason for this can be found in the notion that an application like Virtuocity had no precedent in the Netherlands. There were no results present for governments to analyze. The use of Virtuocity accounted for an increase in bounds of rationality. The choice to implement Virtuocity was in both cases made mostly on the basis of extra rational components as Dror predicts (Dror, 1968). Both local governments were completely unaware on how citizens would react to Virtuocity, therefore the local government of Helmond did not include voting in the application, because of fear citizens would vote for something the government would disapprove of.

Satisficing

Secondly there is the concept of satisficing, this is choosing a sub-optimal alternative because there is no time, money or knowledge on consequences to search for an optimal alternative (March, 1994). This can be found in the design process of Virtuocity far more than in the design process of the urban center of both cities.

In designing policy for the use of Virtuocity it becomes clear that a satisficing solution was implemented in both cases. The reasons for this were firstly the notion that consequences could not be predicted and costs and benefits were hard to calculate, secondly risk averting behavior constituted for this as well. For Tilburg time was also pressing so searching for alternatives even longer would prolong the process and the deadline would not be reached.

Some instances can be found. Firstly Helmond chose to use Virtuocity the way they did but they hoped to have a voting moment like Tilburg. Additionally they wanted not only one area of Helmond online but the entire city. They chose for the option they did since the optimal solution would be very costly and they could not predict whether the application would be successful. Fear for the risks of a voting moment withheld them from installing one. The alternative chosen therefore can be regarded as satisficing instead of optimizing.

Secondly in Tilburg it is also clear that the situation was less than optimal, for optimality a formal referendum should have been held and fraud should have been prevented better. In the words of the municipality of Tilburg, approximately 60 percent of the ideal situation was achieved.

Thirdly the city of Tilburg had to settle for a satisficing solution on the forum, they did not want this function to be in the application but CEBRA urged them to place it within Virtuocity. On the side of the government of Tilburg this was sub-optimal.

Finally CEBRA had to settle for a sub-optimal solution in the conflict on what was more important, accessibility for many or more pixels in the screen. CEBRA and the architects wanted the design to look as fancy as possible but the government of Tilburg argued that a visual application of this magnitude would account for problems in accessibility, since not all citizens own a state of the art computer. The local government of Tilburg got its way and CEBRA and the architects had to settle.

Conflict of Values

The third building block of the conceptual framework of policy design is conflicts of values (Etzioni, 1967). Where in the first arena in Helmond no conflict could be found and in Tilburg the amount of conflict was limited, in the design process of Virtuocity this turns out to be the same. In Helmond still no instance of conflict can be found, this can be explained by the fact that the city of Helmond let CEBRA make all the technical decisions on the application and just went along. In Tilburg however there were some instances for conflict.

Firstly there was a conflict on the scope of the application, communication versus information. The local government of Tilburg did not want a forum and a chat within Virtuocity since they did not regard Virtuocity as a communication device. CEBRA urged the government to place the chat and the forum in the application anyway. In the end the forum and the chat were included.

A second conflict dealt with accessibility versus technical excellence. Where the city of Tilburg wanted as many citizens possible to be able to access Virtuocity, CEBRA and the architects wanted the resolution on the screen to be as high as possible in order to give a good view of the city, with the consequence of making the application run more difficult. In the end the government of Tilburg got its way and accessibility was given priority.

Power

The fourth building block in the conceptual framework of policy design deals with perceived power, the relative power as perceived by actors. This is important since actors use their power to see more of their ideas back in the final policy design (Etzioni, 1967; Dahl, 1961).

In the process of designing policy for Virtuocity in both cities most power stays with the government. They decide what citizens can see, what the features of the application are, what possibilities citizens have and in Tilburg which design they can vote for. This corresponds with the reinforcement thesis, claiming that technology will enforce those already in power (Kraemer & King, 1986).

Furthermore it must be noted that in the designing of Virtuocity a lot of power moved towards CEBRA. In Helmond all CEBRA's advice on how to design Virtuocity was actually implemented and there was a lot of trust between the local government of Helmond and CEBRA. In Tilburg CEBRA also held a large part of the design process, urging the city to include a forum. This corresponds with Winner's thesis, claiming that when using technology technicians gain in power since governments often do not have the knowledge or skills to deal with complicated applications (Winner, 1977).

Formal Institutional Features

A fifth building block in the conceptual framework is the formal institutional features; these can be placed on the structure side. These formal institutions, laws and regulations determine the scope of actions possible (Ostrom et al., 1994).

In designing the application it can be found that the formal institutional features can make these kinds of e-government practices very difficult. First of all in Tilburg the voting did not have the character of a formal referendum since this would legally be very difficult. If the vote had the character of a formal referendum groups would be excluded, which would make the process not democratically legitimate. Also the means to detect fraud were not available; therefore a formal referendum was out of order.

Secondly in Helmond attempts were made to achieve a situation in which voting was in order but this failed because of opposition. This demonstrates that in these cases the institutional setting makes these initiatives of e-government very difficult (Kingston et al., 2000). It becomes clear here that in the policy design process in both cases regarding the use of Virtuocity the existing legal boundaries have a large impact on the policy on Virtuocity.

Rules in Use

Next to the formal rules the informal rules also partly determine the scope of action possible (Ostrom et al., 1994; Stone, 1997). The rules in use were different for Helmond than for Tilburg. In Helmond the rules in use dealt with leaving a lot up to CEBRA and there was a lot of trust between these two parties. In Tilburg the local government tried to hold matters in its own hand to a larger degree, a few conflicts with CEBRA can be distinguished here, as described above.

Culture

The final building block of the conceptual framework of policy design on designing Virtuocity deals with culture. Leading values and norms influence the actions possible and therefore they influence the final policy design as well (Ostrom et al., 1994).

A first instance of culture in both cities was a culture of risk aversion. Since GIS are fairly new, consequences of policy are not very easy to predict and influence by citizens can move out of control, the two cities therefore did not execute the complete plan because they feared the risks. Helmond decided not to vote for a shopping mall since they were unsure on how citizens would react. This shows that governments seem to be reluctant in using e-government applications while consequences are hard to predict. Risk aversion is the cause of why governments are reluctant to push e-government applications to their full potential as seen in other cases (Carver, 2000).

Summarizing this it can be found that the bounds in rationality in this arena have only increased since the consequences of using Virtuocity could not be predicted. Furthermore there are several instances of choosing a satisfactory solution instead of an optimal solution in Tilburg but not in Helmond. This difference can be explained by the relation both local governments had with CEBRA. In terms of conflict and power it can be found that in Tilburg several conflicts can be found, mostly between the local government and CEBRA but that in both cases most power remained with the local governments. For the formal institutions it can be said that they seem to hinder these kinds of practices of e-government while the institutional setting is not adapted to applications like Virtuocity. The rules in use mostly account for the way the local governments deal with CEBRA and finally culture shows a clear culture of risk aversion due to the increased bounds of rationality.

10.5.2 The influence of Virtuocity in Implementing

Now the core concepts of the conceptual framework of policy design have been filled in for the case designing the application of Virtuocity the conceptual framework itself can be addressed. By using the three parts of the conceptual framework and the four channels of interaction the case can be analyzed.

The first part of the conceptual framework deals with the action arena (Ostrom et al., 1994). This is the space in which all actors interact with each other. There are several groups of actors in the policy design process of Virtuocity. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They then use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

In this arena of designing Virtuocity the same actors can be found as in the first arena where the urban centers were designed. Except for the citizens, they did not take any part in the design process of Virtuocity. The actors who do interact are the local governments of Helmond and Tilburg, CEBRA and in Tilburg the architects.

The second part of the conceptual framework of policy design deals with the characteristics of the technology. Here it can be found that the same occurs as in the first arena, in Helmond closure on the meaning of technology had occurred all actors agreed that Virtuocity was a tool for communication and visualization. In Tilburg this closure on the meaning of technology has not occurred. It must be noted here that the prime problem with closure on the meaning of technology in the first arena laid with the citizens, they did not believe Virtuocity would empower them. In the second arena the problem lies mostly between the local government of Tilburg and CEBRA, on whether Virtuocity is a tool for communication or just visualization.

The third part of the conceptual framework of policy design deals with structure. This structure is made up out of three building blocks. Firstly there are the formal institutional features (Ostrom et al., 1994). They as demonstrated above, hinder applications like Virtuocity and make the use of the full potential of the application very difficult. Secondly the rules in use account for, in this case, how both local governments interact with CEBRA. In Helmond there was a large amount of trust; Tilburg wanted to keep matters in its own hands (Ostrom et al., 1994). Finally culture shows that risk averting behavior is very determining for the actions in the action arena (Ostrom et al., 1994). Since consequences of the use of Virtuocity could not be predicted, both local governments were reluctant to implement the application with all its functions.

After dealing with the three parts of the conceptual framework the channels of interaction can be looked at.

The first channel of interaction is the channel moving from structure to the action arena. The influence of this channel is described above.

Secondly there is the channel influencing the action arena by technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artifact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992). As was the case in the first arena, in the process of designing policy for Virtuocity itself in Helmond closure on the meaning of technology had occurred but in Tilburg it had not.

This brings us to the third channel, the channel moving from technology back to the action arena, although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992). In Helmond this is clear, since closure on the meaning of technology had occurred all actors viewed Virtuocity the same way and therefore the local government and CEBRA interacted in a manner motivated by mutual trust. For Tilburg this was different, there were several conflicts between CEBRA and the local government which were mostly based on what Virtuocity should be. In both cities all agreed that most power stayed with the local government and therefore all actors acted upon this.

Finally the channel from technology to structure, after the actors in the action arena have shaped technology and closure on the meaning of technology occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). In the case of Virtuocity this is hard to be found, the formal institutions are not influenced, a formal referendum with these kinds of applications is still not possible, the rules in use have also remained the same. Only for culture it can be said that after Virtuocity was shaped, and even though in Helmond closure on the meaning of technology had occurred, a new application like Virtuocity still caused fear. Since consequences could not be predicted local governments adapted a culture of risk aversion.

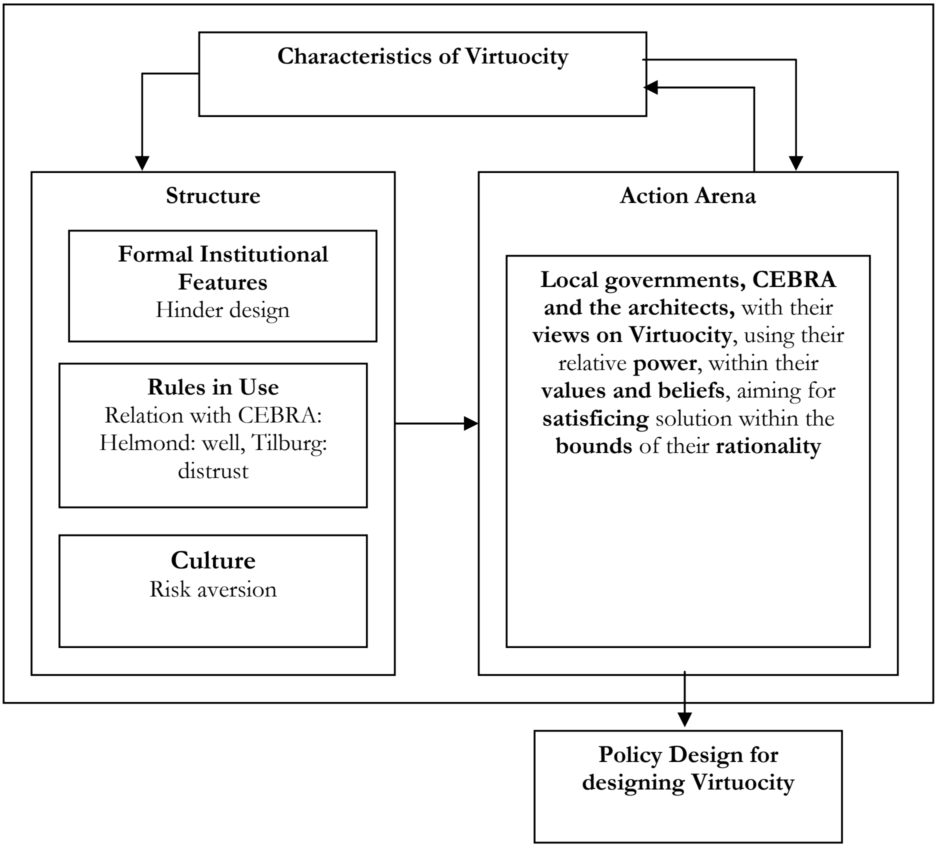

Figure 10.6: The Conceptual Framework of Policy Design

10.6 CONCLUSION

When coming back to the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of policy design?" First of all it must be concluded that when dealing with the influence GIS have next to the arena in which the policy design on the urban planning occurs simultaneously another arena rises on how to design and how to implement the GIS application at stake. This has happened in both cities dealing with Virtuocity as well. Therefore we must deal with both arenas.

It can be found that GIS had an influence on the process of policy design when looking at its qualities and effects and an influence when looking at the conceptual framework.

When starting of with the influence which deals with the qualities and effects of GIS a number of things can be concluded.

First of all GIS had an influence on policy design by its visualization function. Through the advanced visualization of the new urban plans in both Helmond and Tilburg citizens, but also governments, had a far better idea on how the urban center would potentially look. Where the policy alternatives formerly in urban planning were seen on a sketch or a maquette, now they were seen in a three-dimensional environment which was easier to comprehend. This made sure citizens could voice their opinion on these plans; therefore, especially in Tilburg with the voting, citizens could execute more power in this process.

Secondly the effect of improved communication which GIS holds had an influence on policy design. This comes forward in citizens communicating with each other on the forum, which in Helmond even grew to be a social gathering space. This also comes forward in the improved communication between citizens and governments, although in Tilburg to a lesser degree. By this improved communication, plans for the urban redevelopment could be adapted better to citizens' wishes and citizens' ideas could be incorporated into new plans.

Finally the influence of GIS is seen in the effect of transparency. Not only were the building plans more transparent for citizens, but they were transparent to far more people since they were broadcast on the Internet. For governments the forum made sure that it was transparent what citizens' complaints were and how they felt on the urban redevelopment. Policy alternatives became a lot more transparent as well, not only for citizens but also for the local government itself. In Tilburg it was of course obvious the different alternatives for the design of de Heuvel became very transparent through the visualization function of GIS so citizens could clearly understand what the different possibilities for de Heuvel were.

When looking at the policy design processes on the urban center of both cities as a whole, there is another effect present, GIS influences the interactions possible and the actions taken. This was set out with the conceptual framework of policy design.

Firstly it must be mentioned that the bounds of rationality in both cities have decreased through the use of GIS. It was clearer for citizens what the potential plans for their urban center were and it became clearer for both local governments what citizens' wishes and critiques were. This accounted for more informed actors in the policy design process.

In this framework it has also become clear that in Helmond closure on the meaning of technology has occurred but in Tilburg it has not. In Helmond this meant that all parties agreed on what Virtuocity was and how to deal with this. Virtuocity was seen as a device for communication and visualization, which gave citizens a larger deal of power than in previous urban redevelopments. Now they could understand the urban redevelopment better but also now they were far more able to communicate with their government on these plans. In the process of designing the policy for the redevelopment the city of Helmond accepted and welcomes the newly found power of citizens. Citizens felt taken seriously and they were listened to by the government. This resulted in a situation in which constantly consensus had to be found on building details which worked out very well for both citizens and governments, conflict between them could not be found.

In Tilburg the case was different, closure on the meaning of technology had not occurred, where the government considered Virtuocity a device for visualization, citizens considered it a device for communication. This resulted in a situation in which citizens were disappointed when the local government did not answer questions or did not react to critique. Furthermore some citizens regarded Virtuocity as a tool to fool them; they claimed that it seemed like they would be empowered by Virtuocity but in fact the government of Tilburg held all power in its own hands, correspondent with the reinforcement thesis (Kraemer & King, 1986). Other citizens and the local government did not see it this way. Both differences in opinion resulted in a situation in which conflict on the urban redevelopment plans occurred and some citizens were very dissatisfied with the result of the voting.

It must be noted however that Virtuocity in both cities was a large success and most of the citizens felt taken seriously and felt that they were being heard.

Furthermore it must be noted the influence of GIS can also be found in the structure. Through the use of Virtuocity the rules in use had to be adapted to the rules of interactive policy-making, this was different from before the use of GIS. Culture shows that citizens do actually want to participate in the redevelopment of their city and in Helmond this was welcomed by the local government.

Next to the first arena in which the policy was designed for the redevelopment of both urban centers, here again, as in the agenda-setting cases a second arena emerges. This arena deals with the process of designing policy on Virtuocity itself, how it should be used, and which features should be implemented.

In this arena it becomes clear that the bounds of rationality have only increased, local governments were unaware of what the consequences of implementing Virtuocity would be and they had no idea how citizens would react to this.

Next to this is can be noted that for closure on the meaning of technology the same goes as in the first arena, in Helmond closure on the meaning of technology did occur and in Tilburg this did not. In Helmond this closure on the meaning of technology made sure the policy design process on designing Virtuocity moved smoothly. There were no conflicts to be found and the relation between the local government of Helmond and CEBRA was a relationship characterized by trust. In Tilburg there was no closure on the meaning of technology, the relation between the local government and CEBRA was a relationship in which conflict occurred, on the nature of Virtuocity, communication versus visualization and on issues of accessibility. Furthermore this lack of closure on the meaning of technology made sure that the government of Tilburg held a lot of power in its own hands and left CEBRA with less power than they had in Helmond.

Additionally it can be concluded that in this second arena the structure was of large importance. Firstly the structure hindered the process of designing policy on Virtuocity since a lot of potential of the application could not be used, for example the possibility of a referendum. Furthermore a culture of risk aversion made sure that the full potential of Virtuocity was not implemented directly because local governments feared that citizens would complain about every detail and because they could not predict the consequences.

When looking at the detailed conclusions above there are three main conclusions which can be drawn here on what the influence of the use and perception of GIS is on policy design in the Virtuocity case.

A first conclusion deals with e-government and interactive policy-making. In terms of e-government Virtuocity shows that GIS can account for a big push forward. They are able to provide for the means needed for e-government but the two cases show the full potential of e-government cannot be reached as long as the parties involved are not able to use their means to this potential. Citizens do not all own a computer or do not have the know-how to work a computer and governments do not have the knowledge to solve problems coming forward in e-government questions. The culture of risk aversion shows that a lot of potential remains unused. Because of fear of unwanted consequences governments choose not to implement and use the complete functionality of GIS. Furthermore the institutional setting does not make steps towards incorporating matters of e-government into the setting. It can thus be concluded that GIS does account for a situation in which e-government and interactive policy-making are possible, in practice the potential remains partially unused.

A second conclusion deals with the approach of social construction of technology as described in chapter 3. The same application was implemented in two different municipalities but the results were different. The perception and the use of GIS were different and the influence on policy design was different as well. In Helmond closure on the meaning of technology had occurred which accounted for good relationships between all actors; in Tilburg this was not the case and relationships were characterized by distrust. This demonstrates the same GIS application can be implemented in different places but the results are not necessarily the same. It depends on the perception of the users and designers of the application what the outcome will be. This is correspondent with the approach of social construction of technology in the technology debate.

Thirdly it can be concluded that this case shows us that the visualization function of GIS goes far beyond the capacity to display data in the form of a map. GIS can be used for advanced visualizations and virtuality as well.

Chapter 11

Particular Manners of Dealing with Particulate Matter

11.1 INTRODUCTION

In recent years particulate matter problemacy has gained attention. Particulate matter, also known as fine dust or aerosols, is one of the substances which causes a deterioration of air quality. What particulate matter is can be defined very broadly, it is a number of different particles with a different composition of different substances.

Not only do national governments take health risks of particulate matter into account, the European Union and environmental organizations do so as well. Because in the Netherlands effects of policy on particulate matter are mostly to be seen in spatial planning, this will be the focus of this chapter. The reason for the presence of particulate matter policy in spatial planning is in the first place because of traffic. New roads will cause for more traffic, which in its turn will cause a higher concentration of particulate matter. The same goes for industry, but also for housing. Next to the effects a building project may have as soon as it is built the building itself also heightens the concentrations of particulate matter in the air.

Regulations and laws have been made to reduce particulate matter concentrations over time and GIS have a large influence here. Applications to measure particulate matter concentrations are often GIS based. Also applications to calculate these measurements into numbers which tell us where the concentrations are too high are largely based on GIS. These measurements and calculations can have a profound impact on how to design policy on spatial planning regarding particulate matter questions.

In this chapter the case of particulate matter will be looked at in order to understand the perceived influence of GIS on policy design. This chapter forms the fifth of a series of six case studies which will bring us further in answering the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?". The first three chapters initially dealt with agenda-setting this chapter will initially deal with policy design, as was the case for Virtuocity.

In order to do so first in section 11.2 it will be explained what the applications calculating and measuring particulate matter actually entail, and how they were designed and implemented and what the outcome of these processes were. In section 11.3 the applications to measure and calculate particulate matter will be looked at for an influence of GIS on policy design. This will be done by analyzing the application for the enhancing qualities and effects described in chapter 2. Next in section 11.4 the more perceived influence of GIS on policy design will be looked at, by using the conceptual framework of policy design. First its building blocks will be looked at and finally the conceptual framework itself will be dealt with, as described in chapter 6. It will become apparent that in the case of particulate matter, just as in the four other cases, a second arena emerges. In the first arena the policy design for the dealing with particulate matter in mostly spatial planning issues is dealt with, but in this second arena this is not the subject. Here actors aim to design policy on the application to calculate and measure particulate matter itself. Policy is designed on the design of the application so to say. This deals with the functions of the application and how it is implemented. This arena will be treated as an arena of policy design as described in chapter 6. First the building blocks of the conceptual framework of policy design will be dealt with and finally the conceptual framework as a whole. In the end a conclusion will be given with an overview of the perceived influence of GIS on and policy design in the case of particulate matter.

11.2 A GIS FOR PARTICULATE MATTER

In recent years particulate matter problemacy has gained attention. Particulate matter is one of the substances to cause a deterioration of air quality. Not only do national governments take health risks of particulate matter into account, the European Union and environmental organizations do so as well. In the Netherlands several applications exist to measure and predict particulate matter. In this section first it will be elaborated on what particulate matter is and what the features of the GIS applications are which are used to measure and predict concentrations of particulate matter. Furthermore the process of implementation of these applications will be elaborated on and finally the outcome of this process will be described.

11.2.1 Features of the Particulate Matter GIS

Particulate matter originates from several sources. In the Netherlands 45 percent of the present particulate matter is caused by human action, these substances are called anthropogenic. These substances either come into the air directly or as a result of a chemical reaction in the atmosphere. The substances we are considering here are among others, sulphur dioxide ($SO2$), nitrogen oxides ($NO2$) and ammonia ($NH3$). Of the anthropogenic particles one third originates from abroad and two thirds from inside the Netherlands itself. This is for 40 percent caused by traffic, by road as well as by water. Other sources are combustion processes in industry, agriculture, and heating in homes. The other 55 percent of the particulate matter in the Netherlands originates from natural sources, like the setup of dust and sea salt.

The different kinds of particles are divided into three measures, first of all the particles with a volume between 2.5 and 10 micrometers (1 micrometer is a thousand of a millimeter), these are termed PM10. These particles mainly originate in the setup of dust and wear debris from engines and brakes. The second measure are the particles with a volume below 2.5 micrometers (PM2.5), these particles mostly originate from tailpipes of diesel engines. Finally there are the particles with a volume lower than 0,1 micrometer (PM0,1) which mostly entail elementary carbon. When not specifically stated otherwise the term particulate matter refers to PM10.

The concern about particulate matter is mainly seen in terms of public health. The presence of particulate matter can attribute to heart and lung diseases, cancer, acute or chronic bronchitis and asthma. The estimate is that each year a few thousand people die as a result to exposure to particulate matter. The smaller the particles are the greater the health risk (Fijn stof nader bekeken).

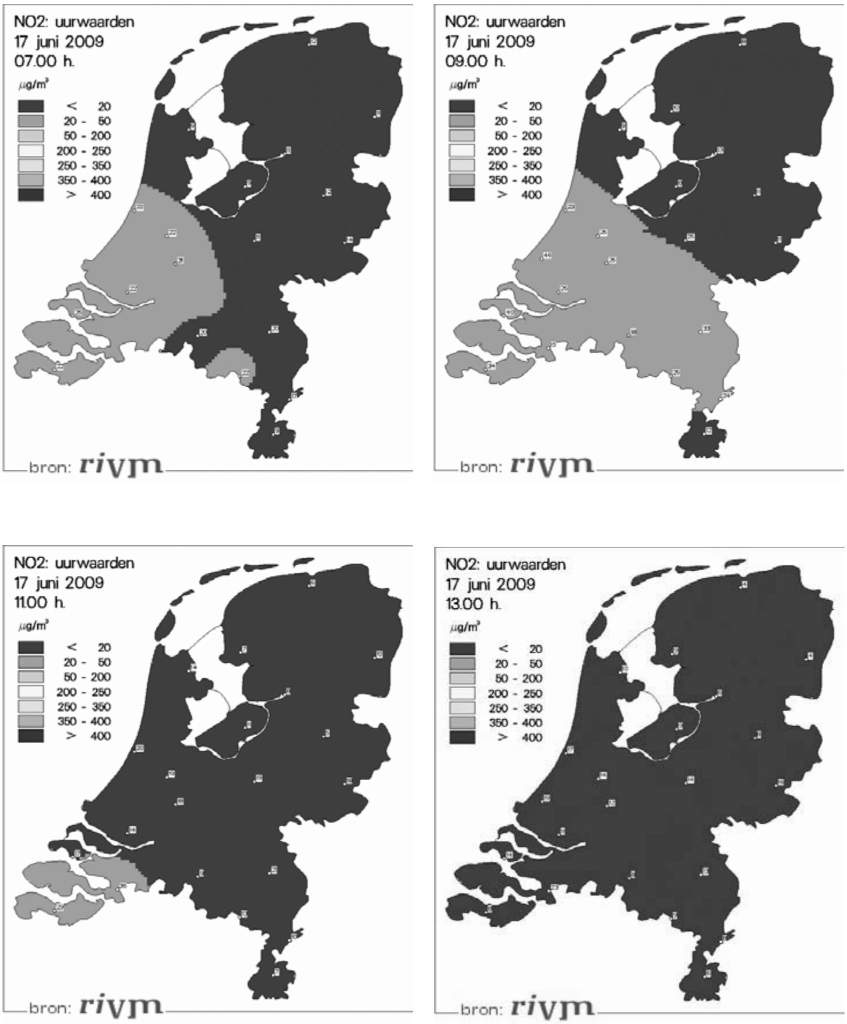

Figure 11.1: Concentrations of NO2 in the Netherlands on June 17th between 07.00 and 13.00 Hours (www.lml.rivm.nl)

The Netherlands as well as the European Union has a number of rules and regulations regarding particulate matter. Also there are rules concerning a norm, which states how high the presence of particulate matter should maximally be.

The health risks posed by particulate matter were the main reason why in the 1990s regulations were negotiated in the European Union. These regulations deal with boundary values, the maximum concentration of particulate matter allowed in the air. In 1996 the National Emission Ceilings Directive came into place (96/62/EG). In 1999, (1999/30/EG) 2000, (2000/69/EG) 2002 (2002/3/EG) and 2004 (2004/107/EG) this was revised and some daughter directives were implemented. The directive deals with 13 different substances making up particulate matter. Each revision deals with different substances.

In Dutch law these directives have been implemented which resulted in the most recent 'Wet Luchtkwaliteit' (Law Air Quality) of 2007, which is based on the National Emission Ceilings Directive.

The norm for PM10 is now stated at 40 micrometer per cubic meter on average per year and 50 micrometer per cubic meter on average per day with the allowance to exceed on this no more than 35 times per year.

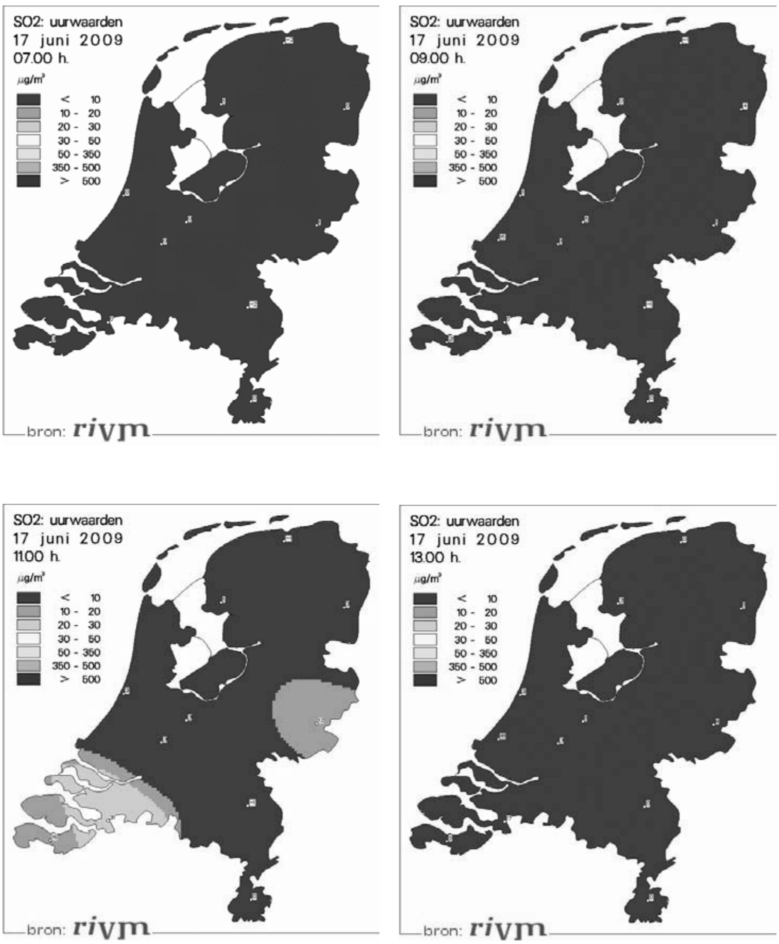

Figure 11.2: Concentrations of SO2 in the Netherlands on June 17th between 07.00 until 13.00 Hours (www.lml.rivm.nl)

What is important within the regulations regarding particulate matter is the NSL (Nationaal Samenwerkingsverband Luchtkwaliteit, National Cooperation Air Quality). The NSL aims to find all the areas in which the presence of particulate matter exceeds the norm. In these areas the Dutch government together with the provinces and the municipalities can implement a program to improve air quality.

The measuring of the amount of particulate matter in any given area in the Netherlands is in the hands of the RIVM (Rijksinstituut voor volksgezondheid en milieu, National Institute for Public Health and the Environment) this is done by the LML (Landelijk Meetnet Luchtkwaliteit, National Measurement Air Quality).

The LML measures the air quality at about 60 places in the Netherlands, by automatic analyzers. Most of the measurements are sent to the RIVM by phone line and placed on the Internet and television text, not only for the different levels of government to see but also for the public. The selection of the exact location on which the measurements are done is very important. These locations have to be distributed realistically over the country, where agricultural areas produce a lot of ammonia, the urban areas produce more nitrogen oxides. This has to be measured out to an average.

The way the concentrations of particulate matter are measured is done by remote sensoring techniques and for this the RIVM uses a GIS. This data is calculated further and presented into a map. Local authorities mostly put the information generated by the GIS in a different, non-GIS related application, because GIS is often difficult to work with.

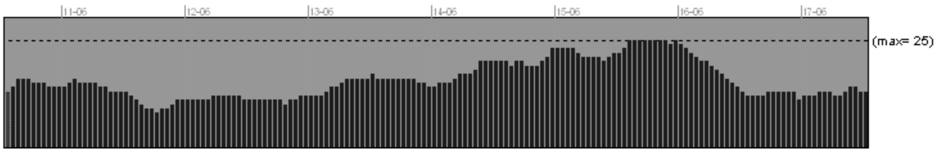

Figure 11.3: Particulate Matter Concentrations at Measuring Point in Rotterdam, The Netherlands from June 16th 13.00 until June 17th 13.00 Hours (www.lml.rivm.nl)

The aim of the LNL is monitoring the air quality in terms of particulate matter, so one can see in time whether air quality has improved or not. Additionally they make sure local and national governments can see where the norm is exceeded and where action must be undertaken in order to make sure that in the future the norm will be met. Furthermore it can tell whether measures taken to improve air quality were successful and to which degree.

Where the LNL measures air quality for the entire Netherlands and gives an overview of the national air quality, local governments can measure the air quality on their own territory.

11.2.2 The Process of Implementation

The daughter directives on the 1996 European Union directives were implemented. The Netherlands implemented the new law on air quality of 2007 which partially ratifies the European Union directives and partially provides for an overview on how to measure air quality. At this point the local governments were bound to commit to improve air quality. What this in practice means is that they had to measure air quality on their territory and on the basis of these measurements decisions had to be made. For example, if one area does not exceed the norm of concentration of particulate matter but fits the norm, the local government cannot build there. Otherwise the concentration would rise and the norm would be exceeded. In areas where the norm is exceeded the local governments must take other measures to help the air quality improve so in the future the norm is not exceeded any further.

This proved to be a problem for two reasons. In the first place local governments were not very happy to discover the norm was exceeded in a lot of places. They were, in their own opinion, not able to build anything anywhere. This came forward in the problem of traffic jams which could not be solved by building extra roads since then the norm would be exceeded. On other occasions this came forward in housing. In some municipalities homes could not be build since they would be located to close to a highway. This is not allowed since the national government does not want people to live in areas where the particulate matter concentration is too high due to traffic.

A second problem was that local governments were unclear on how to measure concentrations of particulate matter. There was a problem on where to measure. This matters since the concentration of particulate matter is a lot higher 50 meters from the highway than 500 meters from the highway. Another problem was how large to make the areas, an area with a lot of industry has a high concentration of particulate matter. If one would enlarge the scale of the area and include for example a forest the average concentration of particulate matter would decrease. Furthermore it was unclear which substances needed to be measured. Some said sea salt did not should not be included since this was natural, others claimed when sea salt would be excluded the norm had to be lowered or else the total concentration of particulate matter would be unrealistic.

Both problems led to enormous conflicts between local governments and environmental organizations. It is stated by law that when the norm for concentration of particulate matter is exceeded because of building it has to go to court. The judge will decide whether the project can continue or not. By being unclear on how to measure, local governments were able, according to environmental organizations, to manipulate the data so a project was allowed but should not be. This by enlarging the scale of the area or by placing the measure poles in a different location. The governments on the other side, accused the environmental organizations of doing just that, to make sure the projects would be stopped while they were legal. It has occurred on several occasions that the responsible judge was not able to decide whether a project could continue or not. The way of measurement and the calculations were so little transparent that a decent decision could not be made.

The national government then decided to develop a tool, which helps local governments in measuring concentrations of particulate matter (Handleiding meten en rekenen luchtkwaliteit)

11.2.3 The Outcome of the Process of Implementation

The result of the process of implementing the application to measure concentrations of particulate matter is that now each hour maps and graphs are published on the Internet and on television text telling the public the concentrations of different kinds of substances. These data are also communicated to relevant government organizations. For the local governments, they measure on a more detailed level what the concentrations of particulate matter are in their territory. Whether they make these data available for the public differs for each municipality. Furthermore the government is committed to make sure the entire Netherlands holds concentrations of particulate matter below the norm. New building projects, either housing, roads or industry, are tested for their future emission of particulate matter and it is checked whether this is possible without exceeding the norm. If not the project may not continue and must be stopped. Areas in which the concentration of particulate matter exceeds the norm are being taken care of and a plan is made in order to make sure they, in the future, will not exceed the norm anymore.

This sounds very positive in terms of improving air quality but there are several problems within the policy on particulate matter. In the first place the calculations are completely unclear to local governments but also to building associations and environmental organizations. This also counts for the judges who are responsible for deciding whether a project may continue. This confusion on calculations and measurements stems from two sources.

The first source deals with the uncertainties in the calculations itself. The RIVM is responsible for calculating the data and must finally come up with a number, which represents the concentration of particulate matter. The point is that the uncertainties on the effects of plans are unclear; also the calculation itself holds margins of error. What this in practice means is that the RIVM has to come up with a number but the number itself is subject to discussion. It is at this point scientifically not possible to give a clear, definite number on what the concentration of particulate matter really is at any given time. When then a project has to be evaluated to see whether it may be continued or not, the decision is taken on the basis of the number calculated by the RIVM. If the number is lower than the norm the project may continue, if it is higher the project must be cancelled. The RIVM acknowledges the margins present in the number and are aware that the number they come up with has far reaching consequences but legally this is the only possible way at this point. The RIVM claims it is really 'rolling the dice' on these projects since one value more or less could account for a completely different outcome.

This has led to a lot of conflict. Local governments and building associations want to build homes, industries and roads. They are very upset when a project cannot be continued. They are even more upset when they hear the project is stopped because of a number which is uncertain in itself. They often claim the decisions on which project can be continued are arbitrary and that their preferred project should have been allowed to continue. Because of uncertain data, calculated with an uncertain calculation based on assumptions gives a number, which is by no means certain they had to stop building. Environmental organizations claim the exact same, but for different reasons. They do not wish to have more roads, more traffic and more housing in rural areas. They claim because of the uncertainty in the numbers. In general the problem lies in the fact that we are scientifically not able to calculate a definite number but the law makes us come up with one.

A second reason the problem of the calculations are unclear and uncertain is because even though the national government made a tool helping the local governments calculating concentrations of particulate matter, the tool holds no legal status. This means that local governments are still able to move the measurement spots and to enlarge or downscale the area which is seen as one unit. What could happen, and does happen according to environmental organizations, is that local governments crunch the numbers over and over again until a project is allowed. When in the first calculation the expected concentration of particulate matter after a building project is above the norm, the local government could just change the parameters until the result of the calculation fits the norm. The other way around the same goes, building associations and local governments accuse environmental organizations of crunching the numbers the same way to make sure a project cannot continue because it would exceed the norm.

The problem thus lays in the idea that all actors, even though opposed in policy preferences, agree the data and results of calculations are subject of discussion. In this case 'knowing is not half the battle'. The computer simple throws out some numbers and nobody trusts these numbers to be accurate.

Developments in informatics, chemistry and science also pose a problem. When new developments in the way calculations are made come forward or when new developments on knowledge of substances themselves come forward a lot changes. Where a decision could be absolutely legitimate today, tomorrow a new insight might be derived and with the new calculation the decision would be complete illegitimate. This adds to the belief that the numbers to which the norm is compared are arbitrary.

Where this sounds fairly negative on the side of technology, all actors do agree this problem is not only present in the case of particulate matter but in all issues in which difficult and complex calculations and measurements are needed. Respondents are not clear on why in the case of particulate matter this comes forward and in other cases the data is trusted. Reasons named are firstly that the issue of particulate matter is fairly new. Therefore the issue is unclear, where issues like water management or climate are older and established. Another reason mentioned in the case of particulate matter is that projects are actually cancelled, the result of the calculations is directly present.

Parties agree the technology brings some advantages as well. In the first place on the side of the national government it is agreed upon that even though there are uncertainties in the numbers we are now at least able to measure something. Other layers of government but also environmental organizations claim the presentation of data in the form of a map helps to obtain oversight on what the problem entails. This makes it easier to communicate this information to citizens and local policy-makers.

Actors also agree the application makes it easier to look at the problem of particulate matter from different angles. However, the environmental organizations claim this is true but that the local governments look at so many different angles until they find one that fits their policy wishes and than claims that angle to be the right one.

Looking at the viewpoint of local governments, environmental organizations but also the national government do not agree on how they treat the norm; the reason for the policy on particulate matter is to improve air quality. An area being below the norm would be a good thing and should be held onto. Local governments often regard a situation in which an area is below the norm as a very good opportunity to build something there. The sheer fact it is still allowed at that location triggers the local governments to build there. This results in a situation in which all the areas below the norm are being built upon so they will not be below the norm for long. On the other hand local governments claim because of the strict rules on particulate matter concentrations the Netherlands is 'locked' and they cannot build anywhere anymore.

Finally it is important to note that according to respondents, citizens are very difficult to mobilize or include in the particulate matter issue. The subject is in essence so complex and much knowledge on chemistry and science is needed to understand only what particulate matter actually is that governments are not able to explain this issue to the public.

Next to the point that particulate matter is too complex for citizens, citizens do not hold a very large interest in particulate matter. According to respondents this can be explained by the fact we cannot see it and we cannot see the effects it can have on public health. There is an estimate of several thousand deaths each year in the Netherlands as a result of particulate matter but medically it is impossible to claim this. For example, if somebody suffers from lung cancer nobody can say for sure this is caused by particulate matter; it could be caused by work, lifestyle, and hereditary factors and so further. For heart diseases the same goes. This causes citizens not to be very worried about the effects of particulate matter, they do not know anybody nor have they heard any story of somebody being ill or dying as the result of exposure to particulate matter.

The fact that citizens are not interested makes it even harder for local governments to justify why there will be no new homes built, or why there will not be another highway so people will not be caught up in traffic every morning.

11.3 Geographical Information Systems and Particulate Matter

After looking at what particulate matter actually entails and how the process of implementing followed together with the outcome of the process of implementing, it is time to look at the influence of GIS and its qualities and effects on the case of particulate matter. This will be done by looking at the qualities and effects as explained in chapter 2.

The first quality GIS is said to have is integration. This comes very much forward in the case of particulate matter (Bekkers & Moody, 2006; Lips et al., 2000, Bekkers et al. 2005; Hout & Bekkers, 1998; Greene, 2000). When looking at integration one can distinguish between integration of different data sets and standardization of work processes. Starting of with integration of datasets it becomes clear that the RIVM has integrated all data on particulate matter concentrations in the Netherlands. Also it has integrated the data needed for predicting the result of building and traffic in terms of concentrations in particulate matter. This makes sure information on particulate matter is less dispersed as it was and it might seem that in this way proper information can be given. Where the information of substances at any given time at any given location was already clear now we see that this is linked to probable concentrations of particulate matter in any potential building plan. This information is linked to one another and in this way it becomes clear whether a plan can continue or not. Furthermore it becomes easy to see the effects of compensation. Standardization is another point. In the case of particulate matter this has not occurred at all. Where the national government uses one application to measure and calculate particulate matter the municipalities do not have the obligation of using the same application. The situation at the moment is that each municipality uses a different application to measure and calculate its particulate matter concentrations.

A second quality GIS are said to have is the function of calculation. Complex calculations can be made by using GIS especially when datasets are being linked (Bekkers et al. 2005; Bekkers & Moody, 2006; Moukomia, 2004). This can be found in the case of particulate matter. By calculating the potential concentrations of particulate matter in the case of a building plan, in theory the GIS used can help establish whether a plan may continue or not. These calculations and simulations were impossible before the implementation of GIS. However, it must be said, as stated above that these calculations are not trusted. Not only is the scientific community unable to make a calculating formula without including a number of margins of error, also actors manipulate the application to their own wishes.

A third quality of GIS is visualization, through a GIS application difficult calculations which were formerly presented in tables or graphs can now be presented in the form of a map, movie or virtual world (Bekkers et al., 2005; Hamilton, 1996; Greene, 2000). This can make sure more people than just experts can understand the data. In the case of particulate matter this is largely present. Presentation in the form of a map can very much help to clarify the issue. The complex calculations made in order to calculate the concentration of particulate matter are a lot more comprehensive in the form of a map. Where the map is used to explain particulate matter to citizens and policy-makers by technicians it is also used by environmental organizations in the same way. The problem lies in the point that in the map the uncertainties of the calculated numbers cannot be presented and made visual. This limits the quality of visualization to a large degree.

Next to qualities GIS are also said to have some effects, firstly the effect of improved communication (Bekkers et al. 2005; Bekkers & Moody, 2006; Haque, 1996). This communication can be divided into communication between experts and the communication between experts, the government and citizens. For the case of particulate matter improved communication between groups of experts cannot be found. This can be explained by the absence of standardization, organizations do not work together because of GIS. For communication between experts, government and citizens, this is to be found in the particulate matter case. First of all most actors dealing with particulate matter consider the GIS used a powerful tool to communicate with policy-makers. Where particulate matter is a complex subject a map can help communicate to policy-makers where boundary values are exceeded. Environmental organizations also recognize this point. It must be mentioned that even though actors agree communication becomes easier by presenting the data in the form of a map this communication is distorted. This is so because the margins of uncertainty cannot be clearly communicated through a map and in the communication with policy-makers this is very difficult to explain. Therefore the communication function in this way is very limited. Secondly the presentation in the map is used to communicate concentrations of particulate matter to citizens. For the national concentrations this is done on the Internet, so citizens can view these concentrations from their own home. For local concentrations it depends on the municipality whether the concentrations are published on the Internet. While the use of a GIS makes it easier to communicate issues of particulate matter to citizens this communication is not taking place. The information is communicated but citizens do not seem to receive this information. Partially because they hold little interest in particulate matter, partially because the matter is so complex they do not understand what the presented maps mean and entail. So where the communication potential might be present it is not fully used at this moment.

A second effect GIS is said to have is the effect of increased transparency (Bekkers et al. 2005; Carver et al., 2000; Moukomia, 2004; Overchuk, 2004). In the case of particulate matter transparency indeed does increase but also decreases on other points. Firstly, by using the information GIS are able to calculate, telling us what the concentration of a particular substance actually is. This improves knowledge on where a territory stands in terms of its particulate matter concentration. Where this information was very dispersed before, now with the laws made to register this it becomes clearer where which concentration occurs. Furthermore by the calculations it becomes more transparent where one could build for example a highway and where one should not.

The policy problem itself becomes more transparent as well by using a GIS; one can look at particulate matter from different angles. It must be noted that the policy problem is not looked at from different angles in order to find a solution but in practice it is only used as scenario sketcher. This means that often when for example a highway needs to be built the information is placed in the GIS over and over again in different ways until the building becomes possible and the concentration of particulate matter stays below the norm.

On the other hand transparency has not increased at all; on the contrary it only decreased. Firstly this happened on the side of the public. The concentrations of particulate matter are available to the public through the Internet, however, citizens do not understand what they mean. If one would look at the published map one could conclude that in his home area NO2 is between 20 and 50 μg/m3 at a certain time. What this actually means for this persons health, or for the plans of building in his area is completely unclear to citizens. In this way transparency for citizens does not increase at all. It must be said it does not decrease either since before the use of GIS the situation regarding particulate matter was very unclear as well.

For governments, national and local, and environmental organizations transparency does not increase either. This because of two reasons; firstly in policy-making the relevant actors have no idea what the calculation actually entails. They do not know and do not understand what is actually calculated. Additionally they do not understand what the outcome of the calculations mean. Secondly because of the insecurities in the variables used in the calculation, the equation and the uncertainty of the effects of a certain concentration, it becomes completely unclear whether an outcome is correct. The margins of insecurity in the calculations are so large that actors believe all outcomes are debatable. Technicians are unable to communicate these insecurities to policy-makers and politics. This means the calculation, the outcome but also the effects are not transparent to policy-makers. In the words of one respondent "The Geographical Information System? I don't understand the norm, I don't understand the calculation, I don't understand the outcome and I don't understand the effect, and to tell you the truth, I don't believe any of them." When a decision on a building plan is made the outcome of the calculation is seen as a nominal number which is the basis of a decision. It is not clear to policy-makers and politics what the basis of this number is. For technicians it is unacceptable that this number is treated this way, because of the margins of security. This decreases transparency severely.

11.4 Particulate Matter and Policy Design

After looking at the perceived qualities and effects GIS are said to have and linking them to the particulate matter case it becomes time to dive deeper into the processes of policy design. In order to look at the influence the perception of GIS has on policy design processes the conceptual framework as developed in chapter 6 will be used to analyze the case of particulate matter as described above.

11.4.1 Concepts of Policy Design

Before moving to the conceptual framework of policy design first the different variables taken from the existing models of policy design must be looked at, since they form the building blocks for the conceptual framework. First bounded rationality will be dealt with, next satisficing, conflict of values and power, fourthly formal institutional features, next the rules in use and finally culture.

Bounded Rationality

The bounds in rationality hold the idea that humans are limited in their capacity to be fully rational. In policy design issues this means that not all alternatives for a policy problem can be looked at and that not all consequences can be predicted (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968). These bounds are clearly to be seen in the process of policy design in the case of particulate matter. It becomes clear the bounds of rationality by the use of GIS in this case on the one hand decrease but on the other hand increase.

Starting with the decrease it becomes clear that now the national government has obtained an application measuring particulate matter. The municipalities have done so as well that concentrations of particulate matter are clearer than before, simply because they were not measured at such detail all together.

On the other hand the bounds in rationality are enormous. This can be seen firstly on the part of science. It is not completely clear how to measure concentrations of particulate matter and what the equation should be, in this regard the bounds of rationality are very large. On top of that the effects of potential building plans in terms of particulate matter are an estimate as well, for the effects on public health the same goes. In the words of one respondent: “in this case knowing is not half the battle at all.”

Therefore it is very difficult to understand consequences of any policy design in this field. For example when one would decide on the basis of the calculations and measurements that a building project can continue this would mean the existing concentration plus the probable concentration when building the project would not exceed the norm. In this case it is so first of all the existing concentration is a number between insecurity margins, as well as the probable concentration. Additionally when science breaks through with more accurate calculations the whole original calculation might not be valid at all anymore. The norm itself might not be correct because we cannot predict the danger of any concentration to public health. For these reasons it is not possible to calculate all costs and benefits of every possible policy alternative, simply because we do not have the knowledge. Consequences therefore are unpredictable and the bounds of rationality thus increase.

Satisficing

The concept of satisficing instead of optimizing (March, 1994) comes forward in several ways in the particulate matter case. Satisficing holds that, because of the bounds in rationality, it is an illusion that policy-makers could find the optimal solution, therefore they must settle for a solution which is satisfactory.

First of all we see this back in the norm itself. The concentrations of particulate matter, which the Netherlands cannot exceed, are far from optimal; this is acknowledged by the European Union, the Dutch government and the environmental organizations. In terms of public health risks the norm should be a lot lower. Since it is now not possible to lower the norm without extensive economical damage the European Union has settled for a less than optimal solution.

Secondly we see satisficing back in the policy on how to decide whether building projects may continue as well as in plans to compensate excess in concentrations. None the actors are pleased with the policy on how to decide on these plans. By law the outcome of the calculations is a hard, nominal number, in reality this number has a large margin of insecurity. But this is not taken into the decision-making process. This has never been a real power struggle between different actors, as one might expect simply because this is the best we can do at this time.

Conflict of Values

The third building block of the conceptual framework of policy design deals with conflicts in values, these conflicts, and their winner, partly determine the outcome of the policy design process (Etzioni, 1967). In the case of particulate matter a number of conflicts can be found.

First of all there is a conflict between technicians and policy-makers on communication. Technicians have developed the applications used to measure and calculate particulate matter however, they seem to be unable to communicate this to policy-makers in an understandable way. None of the respondents on the side of policy-makers or politicians were able to understand how the application actually worked and had no clue on what it actually calculated. This causes a conflict in which the technicians have made an application, which is politically unable to be communicated.

The reason for this brings us to the second instance of conflict, namely the conflict between the scientists and policy-makers, again a conflict of communication and understandibility. Particulate matter is such a complex matter that scientists cannot communicate it to policy-makers, nor to the public. Hence the reason why technicians cannot explain the application, the variables are too vague and the calculations too difficult. The real conflict lies in the fact that policy-makers, in order to make accurate policy on building projects, want a hard, nominal number to base their decision on. The scientists are not able to provide for such a number because of the insecurities already mentioned. In practice the scientists seem unable to explain to policy-makers and to politics the meaning of this insecurity.

Another conflict occurs between scientists and policy-makers, this is the conflict on scale issues. According to respondents, often a (mostly local) policy-maker wants to take measures to reduce concentrations of particulate matter on one spot, namely the location on which the concentration exceeds the norm. Scientists claim in favor of a more integrated approach. What this means is that the scientist believe that exceeding concentrations of particulate matter should not be looked at per location but per region. In this way larger measures can be taken into account to reduce the concentration at several locations at one time. Local policy-makers often choose not to do so because, according to them, these measures are very costly and require too much time to investigate.

Furthermore a conflict occurs between environmental agencies and the national government together with the European Union on the norm itself. The national government regards the norm, as the best we can do without causing significant economic and social damage. The environmental organizations consider the norm too low, and believe the time that the norm lowers should be sooner.

A conflict can also be found between the environmental organizations and local politics and building corporations on the legitimacy of the use of the application. Here we see the environmental organizations do not agree with the way the local governments and often building corporations deal with the application itself. The building corporations and the local governments would often like to build (highways, housing and so further) and claim that this is still allowed without exceeding the norm. The environmental organizations claim this to be untrue. They claim that local governments keep putting the data in the application over and over again in slightly different ways until the calculation fits the norm (for example by enlarging the scale of the area). This works visa versa as well, local governments and building corporations accuse environmental organizations of doing the exact same things, so none of the building plans can continue. Another matter in which these two groups come into conflict with one another is in terms of what the norm actually means. Where local governments often regard areas in which the norm is not met as places where they can still build, the environmental organizations do not. They consider being below the norm as something that should be kept that way. They accuse local governments of not understanding the purpose of the norm to begin with, namely the reduction of particulate matter concentrations. This problem in perception has caused a number of clashes between the two groups of actors.

Finally we see a conflict between politics (local and national) and citizens. As stated, citizens seem not to be very interested in particulate matter issues. The citizens who are interested, are not able to gain information they can understand. There is no website explaining what the data presented to them actually means. Furthermore citizens are often angry that building projects are stopped because they would exceed the norm. An example is to be found in the municipality of Dordrecht where a large parking space could not be built for this reason. Citizens were very angry because they claimed there was no room to park and without this parking lot it would only become worse.

Power

Power can be linked to these conflicts in values, the perceived relative power of all actors determines who wins in the conflict, and will therefore see more of his ideas back in the final policy design (Etzioni, 1967; Dahl, 1961). In the case of particulate matter a number of issues on power can be found.

First of all when looking at the groups the national government and the European Union still hold a large deal of power. They are the ones deciding on the norm and how to deal with this norm. In terms of the reinforcement thesis we see that here the ones in power are strengthened by the technology in this way (Kraemer & King, 1986).

The scientific community has a large deal of power. They decide how to appropriately calculate the concentrations of particulate matter and what the outcomes mean.

Furthermore the technicians developing the applications by which the measurements and calculations are made hold a large amount of power. Nobody in policy-making and politics actually understands how the application works and simply assumes that the technicians have done it the best they could. This corresponds with the power Winner attributes to technicians (Winner, 1977).

When looking at the local governments two things can be noticed. Firstly they have lost power, before there did not exist any regulations on particulate matter. They had more say in what was to be built on their territory. Now with these new regulations they are bound to them. While it may seem as if local governments have lost power because of existing regulations they are very able to cope with this. In the applications used it is still possible for local governments to keep entering the data in various ways until their preferred plan fits the regulations on particulate matter concentrations.

For environmental organizations the same goes, they feel like they are given more power by the fact that there are regulations on particulate matter concentrations. But they are also able to manipulate the data so their preferred outcome will be achieved.

Citizens have no real power, they have the possibility to go online and check the concentrations on particulate matter on the national level and in their own region (provided their own municipality makes these data available). The information online is often not clear to citizens. Furthermore citizens do not have real power to voice their opinion in the particulate matter case, this because the matter is too complex in itself. Especially environmental organizations advocate more information to the public on an understandable level.

What is also important here is that the RIVM and the Ministry of Housing, Spatial Planning and Environment are in conflict here. The core task of the RIVM regarding particulate matter is public health and thus a reduction of particulate matter. The Ministry has to balance this against economic interest. Where reduction of particulate matter might mean less new roads and less transport or less industry the economic impact of this could be grand.

Formal Institutional Features

The fifth building block of the conceptual framework of policy design is the formal institutional features. They determine what is legally possible in terms of policy design in particulate matter issues (Ostrom et al., 1994). In the case of particulate matter these formal institutional features have a large impact.

Local governments can build within their territory but the formal institutional features, as the European law and the Dutch law, prohibit them to do so when the potential concentration of particulate matter will exceed the norm. These laws, European as well as Dutch, are given in this case and bind the local governments.

It must be noted that because of the present insecurities and the possibilities for municipalities to choose their own application to measure concentrations of particulate matter they are able to manipulate the data. So where the norm is very clearly institutionalized the way to achieve the concentration of particulate matter is not. The Dutch national government provides for guidelines on how to do this but these guidelines are only advisory and not obligatory.

Furthermore it is formally established that a judge judges whether a building project may continue or not. This decision is based on the outcome of a calculation and how this corresponds with the norm. As stated these outcomes are a constant subject of debate. Where it thus seems that all room for policy design would be taken away because of the legal setting in this matter this is not the case.

Finally it must be noted the rules made for exceptions in the particulate matter case are laid down by law, but only after the original rules were implemented. This was done because these consequences where unforeseen at the time of the implementation of the original law.

Rules in Use

The rules in use, the informal rules, are also important next to the formal rules; they matter to a large degree on how interaction is conducted (Ostrom et al., 1994; Stone, 1997). In the case of particulate matter this is to be seen on several occasions.

First of all the rules in use present a situation in which each outcome of each calculation is debatable. Either building corporations believe the calculation is not correct and the outcome is uncertain, or the environmental organizations do so. This holds that any decision made on a building project is always illegitimate in someone's eyes. This makes that most parties distrust one another. Where building corporations believe that environmental organizations will stagnate any building plan, environmental organizations believe that building corporations only want to build and do not care about the environment. This goes for local governments as well; they often accuse environmental organizations of manipulating the data, the environmental organizations accuse the local governments of the same thing.

Furthermore all involved actors agree on the idea that these decisions on spatial planning policy cannot be made by the numbers produced by the calculations made because insecurities are so high. The rules in use here are thus to use these nominal numbers, as laid down by law, but to constantly debate the decisions and the policy design resulting from them.

Another rule in use at present is not to include the public in these matters to a large degree. Information to the public is often difficult to understand and effects of particulate matter are unclear to most people. According to the environmental organizations this should change.

Culture

The final building block of the conceptual framework of policy design deals with culture, the leading values and norms in society. They influence the actions actors take and the content of the policy design process (Ostrom et al., 1994).

On culture there are a number of things to be mentioned, firstly there is a culture of distrust in the area of particulate matter. All the calculations and outcomes are perceived as debatable. Several actors accuse each other of manipulating the data so the data fits their cause. This results in a culture of distrust between all parties and hinders communication severely.

Secondly, in a number of local governments the particulate matter laws and the measures they have to take to reduce concentrations of particulate matter are perceived as a burden. They hinder all spatial development plans and the environmental organizations are "on their case to much". This results in a culture in which the particulate matter concentrations are not perceived as a health related issue at all but that it is perceived as a huge burden from which they need to find a way out of.

What is also clear is that we are dealing with a culture in which it is often believed that when we measure something we can be sure on this measure. A culture which is used to dealing with hard numbers, in the particulate matter case this becomes clear when decisions on building projects are made on the basis of such number while all parties agree that this number is arbitrary.

Thirdly and very importantly in the Netherlands there is no established culture dealing with particulate matter or air quality to begin with. Where it is accepted that some building plans cannot continue because of flooding risks (since the Netherlands holds a large history of dealing with water) this is not accepted in the case of particulate matter. Reasons for this could be the particulate matter issue is fairly new but it could also be caused by the level of abstraction of the issue. Additionally since people find it difficult to understand effects of particulate matter and since science is not completely clear on this as well this acceptance might be lacking.

Summarizing this we see the bounds of rationality have not been lifted. The complexity of the matter itself and the margins of insecurities in the calculations make sure consequences of any policy cannot be accounted for. Also this makes sure that it is not possible to review all alternatives. Furthermore we see that the conflicts in values are large and mainly based on how to interpret the numbers resulting from the calculations. A large deal of power flows over to technicians and scientists. On the structure side there is a culture of distrust, and a history of dealing with particulate matter is not present. Furthermore actors manipulate the data for their own cause. Formal institutions make sure that there is little to decide on, all decisions are taken already.

11.4.2 The Influence of the Application on Particulate Matter Policy

After looking at the separate building blocks of the conceptual framework of policy design it is now time to look at the conceptual framework as a whole. The case of particulate matter can now be analyzed through the three parts and four channels of the conceptual framework.

Starting of with the first part of the conceptual framework, there is the action arena (Ostrom et al., 1994). This is the space in which all involved parties interact. Here there are several groups of actors in the policy design process of implementing applications for measuring and calculating particulate matter. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They then use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994). There are several parties to be distinguished: First of all the European Union, the national government, the local governments, environmental organizations, building corporations, technicians, scientists and the public (to a lesser degree). These parties can be further distinguished in groups or coalitions. The European Union forms one coalition while establishing the European Law. A second coalition would be the RIVM as part of the national government. Thirdly the ministry of Housing, Spatial Development and Environmental Affairs form a coalition as part of the national government. A fourth coalition hold the municipalities. Fifthly there are the environmental organizations. The sixth coalition deals with the building corporations. Seventhly the technicians and scientists are in a coalition together, this for the reason they together developed the application and together established how to measure and calculate. A final coalition consists of the public.

Furthermore all the coalitions in the action arena use their relative power to see their preferred policy alternative move forward towards an actual policy design. The battle between policy ideas mostly moves between the RIVM and the ministry of VROM, where the RIVM is generally in favor of reducing concentrations of particulate matter the ministry of VROM has to balance this against economic interests. A second conflict is the one between municipalities and building corporations on one side and environmental organizations on the other. Where municipalities and building corporations would still like to build environmental organizations want to prohibit this for reasons of air quality. Both opponents ground their argument in the inaccuracies of the applications.

We see that within the action arena actors and coalitions opt for a satisficing solution, because time and resources are often lacking and that they do so within the bounds of their rationality.

The second part of the conceptual framework deals with the characteristics of the technology itself, the application to measure and predict concentrations of particulate matter. It is important to look at the shaping of this technology. The actors involved have shaped the application and given meaning to it. The applications to measure, calculate and present concentrations of particulate matter are mostly seen as a calculation device. Only the RIVM considers it to be a communication device additional to the calculation device. Furthermore all involved actors and coalitions agree the application is mainly a source of power. Each coalition accuses other coalitions of using the application in such a way that data can be manipulated and outcomes are manipulated only to serve one's purpose. Where the RIVM, the scientists and the technicians do recognize the uncertainties in the data they are the only coalition who does not believe the application to be untrustworthy. All together in the particulate matter case closure on the meaning of technology has occurred since all view the application the same way, namely an untrustworthy and manipulable tool for calculation.

The third part of the conceptual framework of policy design deals with structure, this structure influences the scope of actions possible in the action arena. The structure consists out of three separate parts. Firstly the formal institutions, (Ostrom et al., 1994) they bind local governments and building corporations to the existing norm. They do this as well for the environmental organizations that do not agree with the norm. These formal institutions do not exactly hinder anyone in the arena but do limit the scope of action possible and limit policy alternatives which could result in a policy design, simply because the existence of the law on particulate matter concentrations. A second factor is the rules in use (Ostrom et al., 1994). They limit interaction very clearly in the action arena. First of all the rule in use of thinking in hard numbers limits all actors in the action arena to realistically deal with concentrations of particulate matter and with solutions or measures to deal with this concentration. The rules of conduct regarding accusations made and distrust hinder cooperation and communication between coalitions. Finally culture has an influence as well (Ostrom et al., 1994), the distrust hinders communication. The fact that there is no culture present dealing with particulate matter makes some decisions hard to accept for some actors.

Looking to the conceptual model as a whole we see four channels. The first channel is the channel moving from the structure to the action arena. Here the structure does mainly two things. Firstly it provides for a framework within which actors have to move, because of the laws made. Secondly the structure hinders all coalitions severely, due to distrust, accusation made, a culture in which all outcomes are debatable. Coalitions are not able to cooperate with one another and are not able to communicate in a constructive matter in finding a policy design which takes all values into account.

A second channel moves from the action arena to technology. Here technology, thus the applications used to measure and calculate concentrations of particulate matter, is made or shaped by the technological frames of the coalitions (Bijker, 1995, Orlikowski, 1992). As said, closure on the meaning of technology has occurred thus actors hold the same frame, that the technology used to measure concentrations of particulate matter is dominantly a technology to calculate and measure. Furthermore the technological frame almost all coalitions hold include the idea that the technology is untrustworthy and can easily be manipulated. The technology is therefore seen as a tool that can be used by each coalition to the disadvantage of another coalition.

The third channel moves from technology towards the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992). This comes forward very clearly in the particulate matter case. In few policies the technology is used as a device for anything else than calculation. Furthermore it can be noticed because of the distrust, the way actors act towards each other is at best questionable, hostile at worst. This hinders the design of a policy in which all coalitions can find their ideas. A problem is that this causes a situation in which in all policy designs on spatial planning there is a winner and a loser. Either the plan will continue or it will not.

Finally there is the channel moving from technology towards structure. After the actors in the action arena have shaped technology and closure on the meaning of technology occurs, the established technology will influence the structure, new rules and laws might be made and it will be embedded in the culture (Giddens, 1984). So the structure is a result of previous actions (Orlikowski, 1992). While the applications are not in use for a long time we can already see the technology does influence the structure. First of all the rules in use have clearly changed, there exist a culture of distrust; this makes it very difficult for municipalities to balance economic interests with air quality measures.

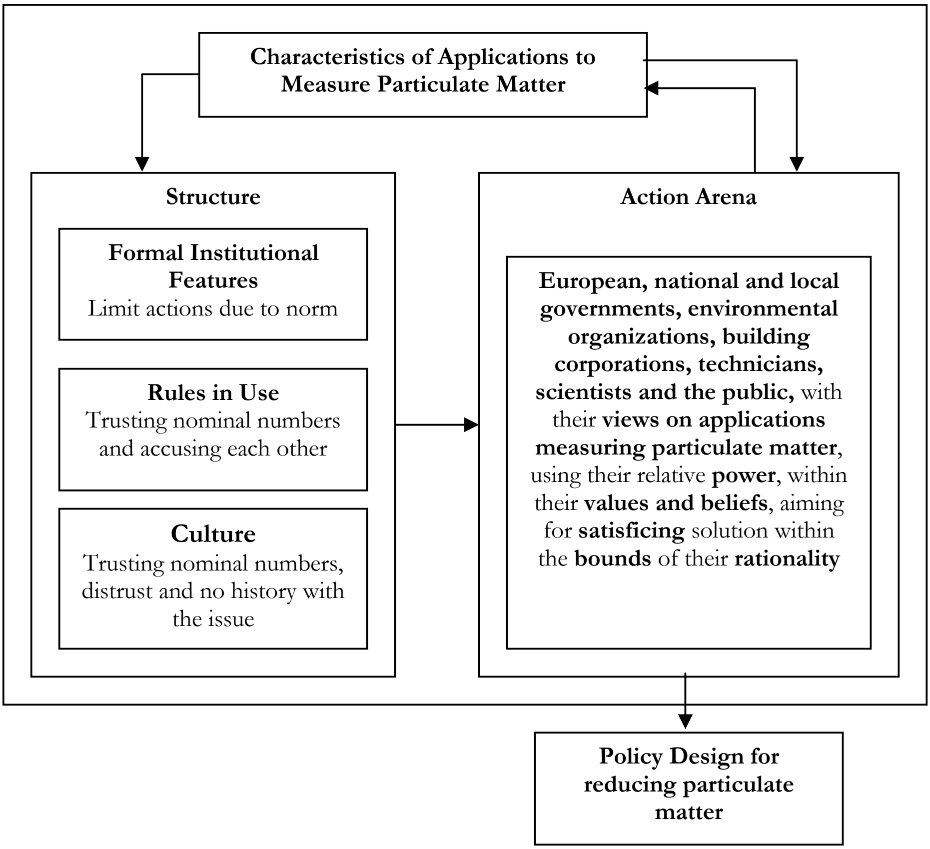

Figure 11.4: The Conceptual Framework of Policy Design

11.5 THE SECOND ARENA, DESIGNING THE APPLICATION

As for the other cases already described, in the case of particulate matter an arena emerged next to the first arena. In the first arena the topic of policy design was how to reduce particulate matter concentrations for the sake of the environment and public health. This was mostly related to spatial planning. In the second arena the applications used to measure and calculate the concentrations of particulate matter are looked at. What are their functions, who has access and who benefits from these applications (Markus, 1983; Goodhue et al., 1992). Below this arena will be discussed.

11.5.1 Designing the Application and Policy Design

Before moving to the conceptual framework of policy design, like above, first the variables taken out of the existing models, the building blocks of the conceptual framework of policy design will be discussed. Bounded rationality will be dealt with first, secondly satisficing, thirdly conflicting values, fourthly power, fifthly formal institutional features, sixthly rules in use and finally culture.

Bounded Rationality

In this second arena the bounds in rationality come forward as well, here GIS also has an influence on how actors are able to act fully rationally (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968). In this second arena it can be found that the bounds of rationality only increase.

Firstly policy-makers at first did not hold into account what the consequences were of the newly implemented law. Municipalities quickly found themselves facing problems. As described above there are cases found in which people should not live in an area with a large concentration of particulate matter. But when they are already living there the rule does not apply and they can remain where they are.

Furthermore the bounds of rationality come forward in the sheer fact that we are unable to calculate outcomes of measurements and their effects on public health with any precision. The application itself makes this very clear. Thus the bounds in rationality lay in the idea the applications are unable to make sure that each incident can be looked at from every angle and calculate every possible alternative.

After the implementation of the first application, the application for the national government and later on the for the municipalities, we can see that the national government had not foreseen the consequences of the way these applications were implemented. Soon they became aware that local governments used their applications in different ways. For example, where one municipality calculated average concentrations on a very large territory others did so on a very small territory. This notion resulted in the Guideline Measuring and Calculating in which the national government gives advice on how to do this.

Satisficing

For satisficing, choosing a satisfactory solution instead of an optimal one because of the bounds of rationality, there is not too much to be seen in this arena (March, 1994). One instance is where by law the outcome of the calculations is a hard, nominal number; in reality this number has a large margin of insecurity. However this is not taken into the decision-making process. This has never been a real power struggle between different actors, as one might expect simply because this is the best we can do at this time.

Another one is that in implementing the different applications for the different municipalities we would like to have one clear way of calculating but we do not. All municipalities are able to insert data over and over again with slightly different calculations and in this way producing an outcome. Since one single application in which this is not possible is not present today, this is simply accepted.

Conflict of Values

In the second arena several conflicts in values can be found as well, the outcomes of these conflicts and the nature of these conflicts influence the process of designing policy on the application for measuring and predicting concentrations on particulate matter (Etzioni, 1967).

First of all there is a conflict between technicians and policy-makers, the matter of communication, as was a conflict in the first arena as well. The technicians have developed the applications used to measure and calculate particulate matter they seem to be unable to communicate this to policy-makers in an understandable way.

Secondly there is the conflict between the scientists and policy-makers. Particulate matter is such a complex matter that scientists cannot communicate it to policy-makers, as in the first arena this causes conflict. The conflict lies again in the fact that policy-makers, in order to make accurate policy on building projects, want a hard, nominal number to base their decision on. Scientists are not able to provide for such a number because of the insecurities.

Furthermore there is a conflict between environmental organizations and the government, local as well as national on accessibility for the public. Environmental organizations want the public to be more involved in the applications. The national government has put its measures on the Internet but these outcomes are often difficult to understand for citizens. Municipalities have no obligation to do so and therefore most do not. Environmental organizations are convinced the public wants to know about particulate matter, provided this is communicated in an understandable way. They are also convinced that the public will help to reduce concentrations on particulate matter if they had appropriate information.

Power

Linked to these conflicts is power. The perceived relative amount of power actors hold determines partly the outcome of these conflicts and will make sure the actor with the most power will see more of his ideas back in the final design on the application (Etzioni, 1967; Dahl, 1961). There are some things that need to be mentioned in this case.

First of all when looking at the groups we see the national government and the European Union still hold a large deal of power. They are the ones deciding on the norm and how to deal with this norm. In terms of the reinforcement thesis we see, just like in the first arena the ones in power are strengthened by the technology in this way (Kraemer & King, 1986). They have also decided on how applications should look, even though municipalities have a choice in which application to use.

The scientific community has a large deal of power as well. They decide how to appropriately calculate the concentrations of particulate matter and what the outcomes mean. The technicians developing the applications by which the measurements and the calculations are made hold a large amount of power. This corresponds with Winners thesis (Winner, 1977).

In terms of local and national government, local governments have lost power in the way that before there did not exist any regulation on particulate matter. They had more say in what was to be built on their territory. On the other hand they have the power to decide which application they would like to use in order to measure concentrations of particulate matter.

In general on power in this arena it can be seen that the main power lies with the national government and the European Union.

Formal Institutional Features

The fifth building block of the conceptual framework of policy design is the formal institutional features. They determine what is legally possible in the design of the application for measuring and predicting concentrations of particulate matter (Ostrom et al., 1994). In this case the formal institutions have a large impact.

Within the implementation process formal institutional features have a very large impact. All the rules and features of the applications, the calculations and the measurements are laid down by law, either national or European. Even though local governments are allowed to choose an application they are not allowed to choose an application that does not meet the requirements.

Additionally it must be said that the national government had no choice. They are bound by European Union regulations to measure and to calculate in a certain way.

Rules in Use

The rules in use influence the second arena as well, (Ostrom et al., 1994; Stone, 1997) the informal codes of conduct in the case of designing the application seem to have a limited influence.

The rules in use are simply to obey the law in the process of implementation. The law was made and discussion on how to implement was not possible anymore. Here we see that new rules in use have not emerged in the process of implementation.

Another rule in use at present is not to include the public in these matters to a large degree, information to the public is often difficult to understand and effects of particulate matter are unclear to most people. According to the environmental organizations this should change.

Culture

The final building block of the conceptual framework deals with leading values and norms in society: culture (Ostrom et al., 1994). In the case of designing the application for measuring and predicting concentrations of particulate matter there is not a lot to been seen that was not found in the first arena as well.

What is present is that we are dealing with a culture in which it is often believed that when we measure something we can be sure on this measure, a culture which is used to dealing with hard numbers. In the particulate matter case this becomes clear when decisions on building projects are made on the basis of such a number while all parties agree that this number is arbitrary and incorrect.

Summarizing this we can state that in this arena bounds of rationality are not lifted, this is caused by unexpected consequences. Furthermore there were some conflicts present where the conflict of including citizens is the largest. Technicians and scientists hold a large amount of power, while they are the ones deciding on the calculations. On the structure side not a lot happens. There is a culture in which decisions are based on hard numbers even though all actors believe these numbers to be incorrect and the decisions to be arbitrary. The action in this arena is not very large. This can be attributed to the fact that discussion was not possible all decisions on implementation and design of the applications were laid down by law.

11.5.2 The Influence of the Application in Implementing

After explaining the content of the building blocks, the variables for the conceptual framework of policy design, the case of particulate matter can now be looked at in terms of the conceptual framework. As explained in chapter 6, the conceptual framework of policy design exists out of three parts and four channels of interplay.

The first part consists of the action arena (Ostrom et al., 1994). This is the space in which all involved parties interact. Here we see there are several groups of actors in the policy design process of the applications to measure and predict concentrations of particulate matter. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They then use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

When looking at the different actors we can distinguish between the European Union, the national government, the local governments, the environmental organizations and the technicians and scientists. The public and the building corporations do not play a role in this arena. All the groups form a different coalition, except for the technicians and the scientists; they are placed together in one coalition for the same reason as described in the first arena. Furthermore the separation between the Ministry of Housing, Spatial Developments and Environmental Affairs and the RIVM is not made. In this arena this separation is not relevant and they both aim for the same design.

The real power lies within the European Union; they have made the laws regarding reduction of particulate matter concentrations in which they force national governments to act. In implementation the national government has formalized everything very quickly so little debate was possible on implementation. Furthermore the local governments do exert power in the kind of application they prefer to use and were very able to make sure exceptions to the existing laws were made. The scientist and the technicians had a lot of influence while they were the ones designing the application and the calculations made within in. Finally the environmental organizations had little power but where very happy to see something implemented with the goal of improving air quality.

The second part of the conceptual framework of policy design deals with the characteristics of technology; since in this arena mostly the same actors are present the same characteristics can be attributed to technology as in the first arena.

The third part of the conceptual framework of policy design deals with structure which influences the actions in the action arena. This structure is subdivided into three parts. Firstly there are the formal institutional features (Ostrom et al., 1994). The formal institutions have limited conflict in the action arena, since all was decided on in advance, either by European law or by national law there was little room to negotiate. Secondly the rules in use account for the same thing (Ostrom et al., 1994) local governments could not do more than just obey the already made law. For culture the same goes (Ostrom et al., 1994), only the environmental organizations tried to include the public more in the applications on which they failed.

In the conceptual framework of policy design there are four channels of interaction which connect the three parts described above to one another.

Firstly there is the channel from structure to the action arena. The content of this channel is described above.

Secondly there is a channel moving from the action arena towards technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artifact it is. Furthermore, humans constitute technology by using it within the meaning they gave it in the process of shaping (Bijker, 1995, Orlikowski, 1992). Closure on the meaning of technology has been established in the same way as in the first arena. The applications of measuring and calculating concentrations of particulate matter are mainly applications of calculation and used as a tool of power for all involved against each other. Only the environmental organizations believe they should serve as a source of information to the public.

The third channel moves from technology back to the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992). In implementation of the applications this is difficult to be found, closure on the meaning of technology has occurred and made sure that all actors view the application as a tool for power which they can use but which can also be used against them. So all actors in the action arena act in the same way by perceiving the technology as such.

Finally there is the channel from technology to structure, after the actors in the action arena have shaped technology and closure on the meaning of technology occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). This is to be found in this arena, first of all in the instance where the formal rules had to be changed in order to make exceptions possible but also in a more complex way. Here we see that a culture of always believing in hard numbers for making decisions is attacked by the way inaccuracies are present in the technology for measuring and calculating concentrations of particulate matter. According to respondents it is perceivable that in the future in particulate matter issue the insecurities will have a larger impact on decision-making strategies.

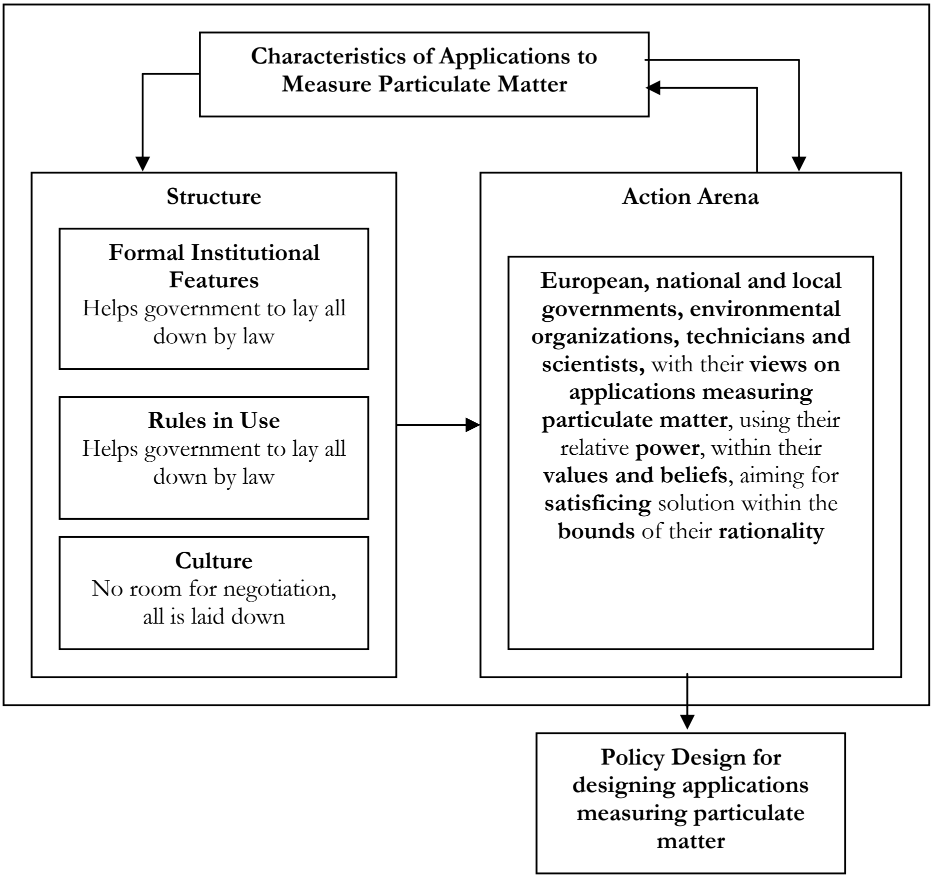

Figure 11.5: The Conceptual Framework of Policy Design

11.6 CONCLUSION

When coming back to the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?" first of all it must be concluded that when dealing with the influence GIS have we see that next to the arena in which is dealt with particulate matter itself simultaneously another arena arises on how to design and how to implement the GIS at stake.

Starting of with the qualities and effects GIS are said to have a number of things can be concluded. First of all there was an effect relating to integration and standardization. Policy design is severely hindered by the lack of standardization. Different municipalities use different applications to measure particulate matter; there is no standardization of work processes, the national government only made an advice on these processes. Since all these applications differ it becomes difficult to compare municipalities and difficult to compare numbers. For municipalities it is unclear what is allowed and what it not. This hinders the process of policy design.

Secondly it can be found that through calculations by the GIS application we know more than before on particulate matter. The data can be calculated but these calculations are not trusted. This causes difficulties in a way that actors manipulate the application and do not trust each other.

Thirdly visualization accounted for a way in which data could be presented but the map in which it is presented cannot show the large margins of error. It can however give policy-makers and citizens an overview.

For the effect of improved communication it can be said that scientists believe the presentation of the data in a map would make it easier for them to communicate particulate matter concentrations to policy-makers and the public. In practice however this is not the case. The use of the applications seems to make communication even more difficult for all parties. The scientific community is unable to explain to policy-makers the inherent margin of insecurity. Policy-makers are unable to explain to citizens what particulate matter actually entails. This accounts for communication to become much distorted. Furthermore communication becomes even more difficult because data are not trusted, local governments and environmental organizations find themselves not hearing each other since they both interpret the data differently. This hinders the policy design process severely. We can conclude that this deterioration in communication should not be attributed to the applications itself. It can be attributed to the complexity of the matter itself and to the fact that scientifically there are no hard numbers to be given at this point. Concluding this case can demonstrate why GIS do not necessarily account for an increase in communication.

Finally transparency must be dealt with; this is twofold in this case. In first instance transparency has increased since now calculations are able to be made and policy on spatial planning can be made based on these calculations. On the other hand transparency has diminished, this because it is not clear to anybody what this calculated number actually means. Therefore, using this number in policy design makes it very untransparent for all actors to know how decent policy should be designed and what the consequences of such a policy are. This makes the process of policy design very difficult.

We also see the applications to measure and calculate concentrations of particulate matter have an effect on spatial planning when looking at the conceptual framework of policy design.

First of all we see that the bounds of rationally have not decreased at all in the particulate matter case. Even though the applications are able to calculate and measure particulate matter concentrations, the meaning of these outcomes in terms of effects and consequences are unclear to policy-makers. Scientists are not able to communicate particulate matter concentrations and what they entail to policy-makers. They are also not able to explain what the insecurity margins mean. This holds that policy-makers are not able to join in a policy design process in which they can act rational.

Furthermore we see that power relations have not changed severely, the real power lies with the national government and the European Union. They have decided on all things relevant, therefore municipalities, as well as the environmental organizations have no say in how to place the norm. Scientist and technicians hold a very large amount of power, while they are the ones actually deciding on how to calculate concentrations. This corresponds with Winners thesis (Winner, 1977) which states that when using ICTs real power is diverted to technicians and they make decisions originally made by elected officials. While in the field of spatial planning a judge has to decide whether a building project may continue on the basis of the calculations made we see clear winners and losers. Either the municipality and the building corporations win or the environmental organizations win. This makes sure in terms of power that in this case there is hardly ever a situation in which a policy is designed by which values of all actors are taken into account. Because the decision on the building project is arbitrary we can conclude the situation in which the application is used real power shifts do not occur and in the end there are absolute winners and absolute losers. Furthermore all involved actors try to use the applications on measuring and calculating particulate matter as a source of power for their cause. It is possible to manipulate the calculations so a number will come out supporting any case. This is what all actors accuse one another of doing.

In terms of structure, culture, rules in use and formal institutions there is a clear culture of distrust. None of the actors trusts the other actors because all believe the other will manipulate the data for their cause. We also see that the rules in use account for this, scientists are very clear on the fact that the data hold large margins of insecurity. This makes sure the data is not trusted by all actors. Where in other cases, like HIS, these insecurities exist as well, in the particulate matter case they are over-emphasized. This over-emphasis can be explained by several reasons. First of all because particulate matter in essence is very complex, the complexity makes sure that actors are unable to really know what they are dealing with. Where flooding is imaginable to many, particulate matter is not, it is too abstract and too vague for most actors to understand what it entails. Another reason is more culturally based. Particulate matter problemacy is fairly new. Where the Netherlands hold a long history of dealing with issues like water and are able to accept the fact these natural instances are not to be calculated perfectly this culture is not present in particulate matter issues. Furthermore we can conclude that because of the fact that health risks and other effects of particulate matter are unclear nobody wants to balance economy against these risks. In other sectors, again like water, the effect of flooding might not be exactly calculated but it is clear to all that flooding will cause severe damage.

Finally we see that closure on the meaning of technology has occurred. All parties seem to agree on what the different applications mean and what they entail. All involved actors consider the technology manipulable and untrustworthy. All actors agree that the technology is not to be understood by any non-technician and that the insecurities in the calculation and in the measurements make that the application does not add anything in terms of objectivity. Furthermore all actors agree the applications, because of the present insecurities, can be used to serve ones own objective.

What the most important thing is the particulate matter case teaches us is that while GIS can hold certain qualities, these qualities do not necessarily have to come forward in each case. Culture, rules in use together with the perception of this technology determine whether these qualities apply. In the particulate matter case we can clearly see the effects we expect from the use of GIS are severely diminished and that a policy design in which values of all actors come forward becomes extremely difficult if not impossible at present. This can be solely attributed to the culture of distrust and the complexity of particulate matter.

Again here we see that next to the arena in which policy is designed on spatial planning another arena emerged, the arena of implementing the application to measure and calculate concentrations of particulate matter.

What we see firstly is that even though this arena does exist there is far less action within this arena as one would expect. This can be explained by the fact that the national government together with European Union has made sure that debate or discussion on implementation was not possible. In the formal institutions therefore this is laid down so strictly that it is not possible to have too much discussion in this arena.

There is some action to be distinguished though. First of all here as well bounds of rationality have not been lifted, the exceptions made on the laws and the implementation of the applications can confirm this. The exceptions on the law were made because in the original law problems with housing were not anticipated. The laws on implementation of these applications for municipalities were unclear to these municipalities and comments were made on the fact that each municipality treated the application differently. No conflict has occurred here but the national government has made an advice.

Furthermore we see that in this arena scientists and technicians hold a large deal of power, similar to the way described in the first arena.

The only real conflict in this arena has occurred between the governments, national and local and the environmental organizations that aim to involve the public more in particulate matter problemacy. Their efforts have largely failed. There is still no obligation for municipalities to present data and if they do there are no rules on how to do so. In practice the information for citizens is highly unclear and too complex to apprehend.

After looking at the more detailed conclusion as given above the question arises, what does this really mean. In the case of particulate matter there are four main conclusions which can be drawn on the influence of the perception and use of GIS in policy design.

The first conclusion deals with the qualities and effects of GIS. It was mentioned in chapter 2 as well as in the other case studies that visualization was a core effect of GIS. Also it was said that GIS could improve communication. In the case of particulate matter this potential has not been reached fully. The visualizations are often not understood and cannot explain the margins of error. Communication has been distorted. What this case learns us is that the potential effects GIS can have will not always occur. This can only occur within a setting which facilitates them. The culture of distrust, the rule in use of conflict and manipulability make sure the potential of communication is not reached. For visualization the same goes, in the particulate matter case actors perceive it as a problem that the margins of error cannot be viewed while this was not so in other cases.

A second conclusion deals with the manipulation of data. We assume quickly that when we calculate or measure something the outcome, especially when this is a number, is correct. The particulate matter case shows us that this is not so. Because of the possibility to manipulate data, and the fact that all actors are aware of this, policy design is stagnated. All actors view the number as untrustworthy and claim the number they have produced is the correct number. The application is so manipulable that several outcomes for the same problem are possible. This shows us that a manipulable application could cause policy design to become more complicated.

There is another reason why policy design in this case becomes more complicated, this brings us to the third conclusion. In the conceptual framework it is assumed that when designing policy the actors will, together, come towards a policy. The actor with the most relative power will see more of his ideas in the final design. In the particulate matter case this is not so. The reason for this can be found in the fact that there are winners and losers. Either a building plan is executed or it is not. A consensus on a design therefore cannot be found. The reason for this situation is not only because a judge judges on the plans but also because of GIS. Because of the application we can measure particulate matter and come up with a number. Without this number clear winners and losers would not exist.

A final conclusion which must be drawn is that municipalities are allowed to choose their own application, so can environmental organizations. This means that a number of actors have access to the data as well as the application. There is no information monopoly. This adds to the practice of calculating ones own number and claiming this to be correct. When all can access and manipulate the application conflict on the reliability of ones opponents outcome increases.

Chapter 12

The Queue Starts Here

12.1 INTRODUCTION

London is the city in Great Britain with the most and the longest traffic jams, and one of the worst cities regarding traffic congestion in Europe. Drivers spend up to fifty percent of their time driving in traffic jams. When Ken Livingstone was elected Mayor of London he promised to tackle the problems around traffic congestions and reduce jams.

A plan was made to introduce a zone in central London in which all drivers would have to pay a charge when driving into the zone. People in this way would be inclined to either make use of public transportation or cycle or walk to their destination. If more people would do so traffic could be reduced and congestion could improve. This was named Congestion Charging. A London wide plan was made so the money gained from the charging vehicles in the zone would be reinvested into transportation. Livingston promised public transportation would improve, more busses would drive on more routes, roads would be improved and additional measures would be taken to improve road conditions for walking and cycling.

Next to the Central London zone in 2007 another zone was implemented in which vehicles entering the zone where charged, the Western Extension.

What we see in the congestion charging scheme is that GIS were used to a large extent. The measuring where the zone should be, the monitoring of traffic, identification of key road point and measurement of effects were calculated by GIS. The entire application running behind the charge is largely based on a GIS. These measurements and calculations have had a profound impact on the way policy was designed on reducing congestion in London.

In this chapter the case of Congestion Charging will be looked at in order to understand the perceived influence of GIS on policy design. This chapter forms the last of a series of six case studies which will bring us further in answering the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?". This chapter will initially deal with policy design.

In order to do so first in section 12.2 it will be explained what Congestion Charging is and how the applications behind Congestion Charging were designed and implemented and what the outcome of these processes were. In section 12.3 Congestion Charging will be looked at for an influence of GIS on policy design. This will be done by analyzing the application for the enhancing qualities and effects described in chapter 2. Next in section 12.4 the influence of GIS on policy design will be looked at, by using the conceptual framework of policy design, first its building blocks will be looked at and finally the conceptual framework itself will be dealt with, as described in chapter 6. Here as in all the other cases a second arena emerges as well. Next to the first arena in which policy on reducing congestion is made a second arena emerges. In this arena the subject deals with designing policy on the application itself to measure and calculate congestion and the zone. This arena will be treated as an arena of policy design as described in chapter 6 as well, first the building blocks of the conceptual framework of policy design will be dealt with and finally the conceptual framework as a whole. In the end a conclusion will be given with an overview of the perceived influence of GIS on policy design in the case of Congestion Charging.

12.2 CONGESTION CHARGING

In 2000 when Ken Livingstone was elected mayor of London he decided right away to tackle the congestion problems which London was suffering from, as promised before his election. At the time London was the most congested city in the United Kingdom and one of the worst in Europe. Drivers usually spend fifty percent of their time in traffic jams. In order to solve this problem a plan was made named the Congestion Charge and this was implemented firstly in February 2003.

12.2.1 Features of the Application

The location of the zone in which the Congestion Charge was implemented was is the eastern part of London. In February 2007 the zone was extended, called the western extension. It is important to know the Congestion Charging was part of a larger plan improving transport in London, including road improvement measures, better walking and cycling facilities, more busses on more routes and an improvement of the subway system. The income the London government would receive from the Congestion Charge would be used to pay for these improvements.

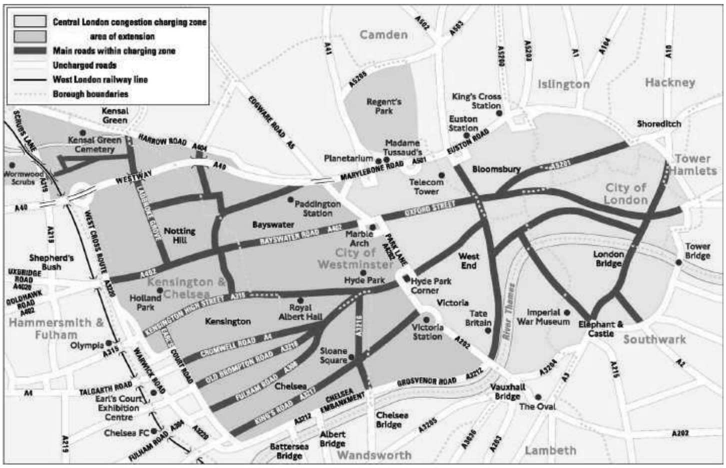

Figure 12.1: Map of the Congestion Charging Zone with the Western Extension. (www.milesfaster.co.uk)

The idea behind the Congestion Charge is that every motorized vehicle except for motorcycles which drive into the zone has to pay a charge. The idea was that when people would have to pay to enter the zone they would search for alternative routes. Therefore traffic would go down together with congestion. Of every motorized vehicle which drives into the zone a picture is taken by a camera. These cameras work with a closed circuit system (CCTV) and therefore make sure each car is photographed and send to a database. In the original zone the camera sends the photograph to a database named ANPR in which the license plate of the vehicle is recognized. In the western extension this is not the case. There the ANPR, which recognizes the license plates is already build in into the camera. After recognizing the license plate the owner of the vehicle will be charged for driving into the zone. When driving into the zone the driver will see a sign telling him that he is entering the zone, upon leaving the zone a similar sign will be seen.

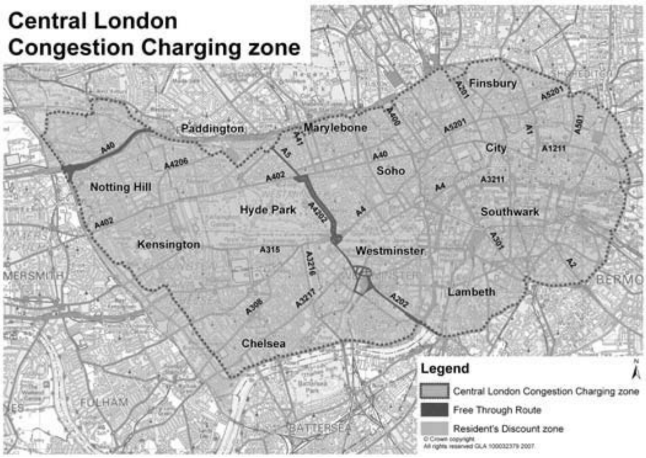

Figure 12.2: Official map of the Congestion Charging Zone with the Western Extension. (www.tfl.gov.uk)

The Congestion Charge is active from Monday to Friday from 7.00 hours until 18.00 hours and the charge is 8 British pounds for each day. The charge should be paid before midnight on the days of travel. If one decides to pay a day later the charge increases to 10 British pounds. A driver making trips into the zone every day could also choose to purchase a monthly ticket (136 British pounds for 20 consecutive days) or an annual ticket (1696 British pounds for 252 consecutive days). When a driver has not paid the charge for any reason he will be send a Penalty Charge Notice (PCN), when paid within 14 days the penalty is 60 British pounds, between 14 and 28 days 120 British pounds and if not paid after 28 days the penalty moves up to 180 British pounds.

There are several exemptions made on this charge. Firstly taxis and busses do not have to pay, furthermore emergency services will not be charged. Also people holding a blue card, a disability license, are excused from charging. Residents hold a 90 percent discount on the charge and some people living right outside the zone who can prove their day-to-day travel is severely affected by the charge can obtain the 90 percent discount.

There are several ways to pay the Charge after or before driving into the zone. One could choose to register, which makes payment simpler but registering is not mandatory. One could pay online on the website of the charge. The easiest way according to TFL is to pay by telephone text messaging but this only possible when registered. One could also pay in stores with a permit for paying Congestion Charge and in a self-service machine, more or less the same as a parking meter. Finally one could pay either by phone, using the buttons on the phone or by mail using a form one could obtain from the website.

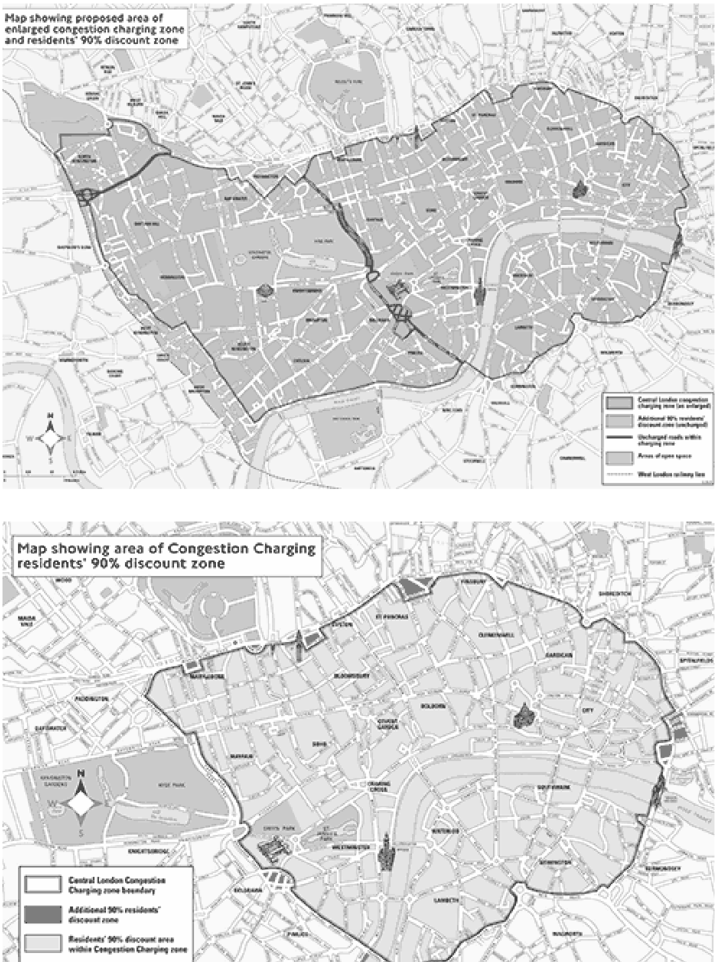

Figure 12.3: Maps of the Congestion Charging Zone, with and without the Western Extension. (www.greenfuel.org.uk)

It must be noted the system of photographing a vehicles license plate and sending it to a database in which the plate is recognized is not a GIS. Then what is the part based on a GIS in the case of London's Congestion Charge? It is the application behind the cameras and the zone, the application citizens cannot see. This application is operated by an organization named Transport for London (TFL)

The GIS in the Congestion Charge matter is used to make simulations and calculate effects. At first it monitored all traffic jams and counted the number of drivers for each road on a day to day basis. On the basis of this the first charging zone was established. It was calculated where the zone should start and end to maximize the effects. In simple terms, it was simulated how congestion would be if the zone started in one street and compared with the amount of congestion when the zone started in another street. On the basis of the calculations the GIS made it become a possibility to implement the western extension. Furthermore, the new bus routes and the amounts of busses were calculated on the basis of the data gathered from the GIS. Now with the Congestion Charge actually in place GIS are still used; firstly to monitor traffic. How much traffic moves from one spot to another, what are the busy crossroads and the most busy areas, where is congestion still a problem. Solutions are also generated, in areas where congestion is still a problem road improving measures are implemented trying to reduce congestion or alternative routes are made possible by road improvement in other locations.

This part of the Congestion Charge, the GIS is not visible for the public but TFL makes sure to publish measures and results on the website of the Congestion Charge.

12.2.2 The Process of Implementing the Congestion Charge

The process of implementing the Congestion Charge was a process full of problems, first in the Central Zone and next in the Western Extension. There were several instances that played a role.

First of all the technology itself; there was a very short amount of time between the announcement the Congestion Charge would be implemented by the Mayor and the actual implementation. Transport for London had to choose a technology by which the Charge could be conducted very quickly. Where Transport for London would have preferred more time to do so because they would want to test different technologies for their costs, accuracy and user-friendliness. This was not possible within the time frame. Therefore Transport for London settled for the solution with CCTV and ANPR, not yet integrated. The CCTV sent the data to a system in which ANPR was installed so the photographed plates could be recognized. The reason Transport for London chose this technology was because the costs and accuracy of this application were clear to them, the results of other technologies were unknown so they chose for a known technology. After the first implementation of the Congestion Charge however Transport for London conducted three technology trials, testing the other possible technologies. CCTV with an unintegrated ANPR has a low accuracy level. According to Transport for London about 90 percent of the license plates are correctly recognized, according to others about 85 percent. The first technology to be tested was to integrate CCTV and the ANPR, which proved great results; therefore, ANPR was integrated into the CCTV cameras in the western extension. A second technology, Tag & Beacon, was tested as well; here each vehicle has an application which sends information to ports on the road. In this way it is made sure a vehicle is noticed when going in or out of the zone. The advantage of this method is that it is fairly accurate and the reading of the license plates is not necessary anymore. This makes sure less mistakes are made. The problem with this technology is that each vehicle would have to have the equipment to do this; people would have to purchase one of these machines which would probably cause some opposition. Batteries of these machines prove to run out very quickly and there is no way of controlling whether people turn their machines on. When the machines are turned off, they would not be recognized. Another technology was GPS by satellite; each vehicle would have to have equipment to be tracked by satellite, every movement in and out of the zone than could be monitored. This possibility was dismissed quickly, there were too little tests conducted proving accuracy and additionally people would have to purchase the equipment. A final technology was trailed, namely using people's cell phones to track them going in and out of the zone. This technology was quickly dismissed as well since in order to do this people would have to download software on their phones and not all phones are suitable for this. Furthermore there is no way of controlling whether people in their car turn their phone on, so fraud could not be prevented. In sum the CCTV integrated into a camera with ANPR proved to be the most feasible method according to Transport for London. The cameras without ANPR were left as they were but the cameras in the western extension were equipped with ANPR. According to others CCTV with ANPR was not the best solution at all, they were in favor of Tag & Beacon technology.

Some more problems with the technology were in place, the technology of CCTV proved to be very expensive. The idea that the money gained with the charge would be reinvested in better roads and more opportunities for cycling and walking and improvement of public transportation could not be fully realized. The maintenance of the circuit of CCTV cost so much that a large sum of the money had to be placed back in the technology itself, this to large protest of Londoners.

Additionally accuracy proved a problem, when the cameras take a photograph of a license plate and this is sent to the system with ANPR there is a margin of error. According to Transport for London 90 percent of all license plates are read correctly, according to opponents this is 85 percent. Even so, a lot of people were very angry when getting a PCN while never having been in London in their life. Forums show a lot of people, as well as residents groups called the system inaccurate and Transport for London incapable.

There were some other problems in implementation regarding the exemptions. Everybody agreed that residents should obtain a discount, just like people with disabilities. How high this discount should be was subject to debate. It was agreed upon that residents should obtain a 90 percent discount and people with disabilities a 100 percent discount. Opponents of the charge argued that people living right at the border of the zone should receive this discount as well, since their life was very dependent on moving back in and out of the zone. For example, a family living just outside the zone, but with their children going to school in the zone and job in the zone would have to pay, depending on whether they had one or two cars, between 40 and 80 British pounds each week. Those in favor of the charge argued these people could go into the zone with public transportation. Opponents in turn argued that while this could be so, in practice this would not work, people working odd hours could not. Furthermore taking the subway, which is often not running, with three infants would be too difficult. Finally it was agreed that those people living just outside of the zone who could prove their day-to-day life was severely influenced could get a discount.

Another problem occurred when those in favor of the charge wanted to increase the charge for vehicles above a certain weight. Opponents where furious, they claimed the Congestion Charge was meant to decrease congestion and it should not be an environmental tax. Furthermore, these vehicles are often owned by companies, this would severely damage these companies and the prices would be calculated to the customer. On the basis of large protest this increase did not make it and was never installed.

A more social problem occurred; the GIS which was used to calculate what the best borders for the zone would be, calculated this on basis of road use. It did not take into account the borders of neighborhoods. The zone was installed on the information gathered from the GIS and the neighborhoods where not taken into account. Londoners where very upset over this. Neighborhoods became divided because the zone installed an artificial border right through neighborhoods. Children going to school, people visiting friends, even going to church in ones own neighborhood became very difficult since one would have to pay the charge.

A final problem in the implementation was the word 'charge'. Transport for London together with the mayor was very reluctant to call the system tax. Since the word 'tax' has a very negative connotation for Londoners, as history had proven, they chose to use the word 'charge'. However, under national law this was possible and the charge was not a tax, internationally however, this was not possible. Especially American diplomats made a very large problem about this, claiming that the charge was legally a tax and that they, being diplomats, did not have to pay taxes, and thus were free of the charge. The London council does not agree and the debate, as of yet, is not settled.

There existed more problems in the Western Extension but those will be discussed in section 12.2.4.

12.2.3 The Outcome of the Process of Implementation

After reviewing all the problems in implementation the outcome of the process is very ambiguous. Firstly as mentioned the system with CCTV and ANPR is maintained, in the western extension this is integrated. While several people still argue for Tag & Beacon technology this is not done.

CCTV and ANPR are still very expensive and maintaining the system costs so much the reinvestment of the money gained in the charge to public transportation cannot be fully realized.

Furthermore an accuracy of at best 90 percent is still very low, meaning that one out of ten license plates are incorrectly recognized. According to respondents and public forums, Londoners are very distressed about this and claim that Transport for London is incompetent.

On the debate whether residents just outside the zone should receive a discount as well, it was agreed they did, provided they could prove their life was severely influenced with congestion charging. In practice it shows that this is almost impossible to prove, resulting in the fact that almost no residents just outside the zone receive a discount.

In general protests against congestion charging are numerous; they go from announcements to public marches. Citizens organized in resident groups; in alliances (as the National Alliance Against Tolls or the British Drivers Association) as well as political parties speak out against congestion charging.

First of all they complain about the system, it would be incompetent and incapable of doing what it was supposed to do. Furthermore they argue that neighborhoods are being destroyed and artificially divided. They claim here that the zone in terms of transport should have been looked at by civil technicians; they take social factors into account. Now with GIS this is all decided by computer programmers who know nothing about transport. They name Ken Livingstone everything from a car-hater to a communist and Transport for London everything in the range from outright stupid to a bunch of children trying to be cool.

Political parties are mostly angry the charge interferes with the freedom to travel and therefore has a large impact on people's lives. A very strong heard point is that the charge would make sure that people outside the zone would become second class citizens. All the best schools, museums and hospitals are inside the zone, so these people would be charged upon visiting them. A large campaign was launched since the only maternity centers are located in the zone. These centers account for information for pregnant women as well as for aftercare and information when their child is born. Political parties argue that these centers where especially made for the lower educated people, but they live outside the zone, and therefore they do not get the care they deserve without being charged. Therefore the charge was classed as 'anti-family'.

Other complaints were heard from the side of businesses; where before people from outside the zone would come into the zone to go shopping they now do not. This accounts for the stores in the zone missing out on income. For the stores right on the border of the zone it would be even worse, a large part of their clientele was from outside the zone. Companies dealing with services in people's home, like plumbing or electrics are charging people extra so they make no losses while driving in and out of the zone. Another problem would be in terms of employment, cooperations on the border of the zone cannot find employees while people outside of the zone do not want to work inside the zone since they would be charged everyday. It must be noted that complaints of businesses are denied by Transport for London, while they claim there are neither losses in profit nor problems with employment.

Maybe the most important point in terms of outcomes of the process, is the question, did congestion diminish? When asking Londoners, they would say no, time in traffic is just as long and congestion is still the same. The answer from Transport for London is a little more nuanced. They agree that congestion has technically not diminished but that because of the charge there are less cars on the road. The reason why congestion has not diminished is because the extra room created by the charge was directly filled in by more busses and road improvement measures.

In terms of GIS the outcome of the process was very satisfying, even though citizens complain about the dividing of neighborhoods, GIS were able to give a very detailed account of how to implement the zone, where the border should be after several simulations. Furthermore they gave a very good view of traffic in the zone and on certain key points while the system also monitors, making sure future policy can be based on these results.

11.2.4 The Western Extension

All the points mentioned above go for the central zone as well as for the western extension. There is one large difference; the western extension will be abolished. Just in 2008 it was promised the western extension will be free of congestion charging as soon as the abolishment process is over.

When the new mayor of London, Boris Johnson, was campaigning he promised to review the western extension, this also under pressure of a very large and competent residents group. A survey was conducted in order to see whether the charge was helpful and how it interfered with everyday life. At first Londoners were upset about the survey. In the first place, the questionnaire was not sent to everybody but one would have to request a questionnaire, the fear was that few people would respond. Secondly, the questionnaire was not perceived valid, according to several resident groups the questions were asked in such a manner that it was very difficult to be against the charge. People felt like the survey was a farce and just a PR stunt. After the results of the consultation came out it showed that over two thirds of residents and businesses wanted the zone abolished.

In contrast to earlier belief of residents the mayor actually promised to listen to the consultation and has taken steps to remove congestion charging in the western extension zone. In order to do this a process has to be started to formally remove the charge in this zone, this process has now started.

12.3 GEOGRAPHICAL INFORMATION SYSTEMS AND CONGESTION CHARGING

After explaining what Congestion Charging entails and how the process of implementation had developed it is time to look at what the meaning of GIS is in this application. It must be noted here that in Congestion Charging, GIS are used in the background of the CCTV and ANPR applications, and that what citizens see (being CCTV and ANPR) is not a GIS, but just Geographical Information. The enhancing qualities and effects of GIS as described in chapter 2 will be used to look at the influence of GIS.

The first quality GIS are said to have is the quality of integration (Bekkers & Moody, 2006; Lips et al., 2000, Bekkers et al. 2005; Hout & Bekkers, 1998; Greene, 2000). This can be sub-divided into integration of different datasets and standardization of the work process. Starting of with the linking of datasets it becomes clear in the Congestion Charging case that the monitoring information of key points is combined with general road use. This is combined with the simulations made on the zone and the expected results, this generated the information needed to install the zone. It became clear by linking the datasets where the zone should start and end to obtain a maximum effect. For the extension the same goes, the effect of the extension was tested against the other data like road use and mobility making sure the extension would have an effect on congestion. In this way new information becomes visible.

Standardization does not occur in the case of Congestion Charging. The reason for this is that in this case it is not so that different organizations are now working together which have not done so before. Transport for London already had a standardized way of dealing with transport, mobility and traffic, the implementation of the GIS simply used the same standard that already existed.

A second quality GIS are said to have is calculation, (Bekkers et al. 2005; Bekkers & Moody, 2006; Moukomia, 2004) this is present in the case of Congestion Charging. By combining different datasets and sketching scenarios on where the zone should start the GIS can calculate the effects of the different alternatives. This makes sure more effective policy can be made.

The third quality attributed to GIS is visualization (Bekkers et al., 2005; Hamilton, 1996; Greene, 2000). Since GIS are used in the background of the entire Congestion Charging Scheme, the only ones who profited from the increase of visualization are within

Transport for London. But a clear advantage was to be seen. Monitoring information on the streets of London in and outside the zone constitutes for a very large dataset. Placing the information in a map makes a simple overview for those with little knowledge about transport or computers. Furthermore the scenarios were tested to figure out which zone, i.e. where the borders of the zones should be, would have the maximum effect. On the basis of these simulations the zone was installed, this was communicated within Transport for London. These results were placed in a map so matters became very easy to understand in comparison with graphs or tables. In the matter of visualization we see that this was less evident than in other cases since only Transport for London was to see the results.

Next to the qualities mentioned above GIS are also attributed with some effects, the first of these effects being improved communication (Bekkers et al. 2005; Bekkers & Moody, 2006; Haque, 1996). In the case of Congestion Charging this does not come forward so much. The maps made by GIS do show what the effects of Congestion Charging are, but this is not communicated to a lot of different people or organizations. Transport for London had the authority to decide on the zone and they calculated the borders of the zone and subsequently the effects of these borders,. Finally they implemented them. GIS therefore were not used to communicate information outside Transport for London. Within Transport for London this was done and the policy-makers there were very pleased with the information gathered by GIS, because again, a map says more than a hundred graphs. For any other communication within the Congestion Charging case GIS were not used.

A second effect GIS is said to have is the effect of increased transparency (Bekkers et al. 2005; Carver et al., 2000; Moukomia, 2004; Overchuk, 2004). Transparency can be subdivided into transparency of the work process, transparency of the policy problem itself and transparency to a large number of people. The only instance of increased transparency which can be found in the Congestion Charge case is increased transparency of the policy problem itself. As explained above, the monitoring application of GIS used, made sure road use and significant key points where recognized and made transparent. Furthermore the calculations made in the scenarios to determine where the zone should be, made transparent where the zone would be finally implemented. In this way the policy problem itself became more transparent and could be looked at from different angles.

However, for Londoners transparency has not increased at all, since the GIS used did not take neighborhoods into account. The borders of the zone felt absolutely arbitrary and these borders do not correspond with known borders, like city borders or neighborhood borders. People are confused on where the zone starts and where it ends. The reason why the zone is at a certain place is not clear to Londoners as well since the results of the calculations are not communicated to them.

12.4 CONGESTION CHARGING AND POLICY DESIGN

Above is demonstrated how the use of GIS can enhance processes of policy design in the Congestion Charge case by looking at the qualities and effects of GIS. Now is the time to move on in applying the conceptual framework of policy design to the case, in order to generate an understanding of how GIS influences the process of policy design. First the building blocks of this framework, the variables taken out of the existing models, constituting the conceptual framework of policy design must be addressed. After that the conceptual framework itself will be used to analyze the case of the Congestion Charging.

12.4.1 Concepts of Policy Design

Before moving to the conceptual framework of policy design, first the variables taken out of the existing models, the building blocks of the conceptual framework of policy design will be discussed. First bounded rationality must be dealt with, secondly satisficing, thirdly conflicting values, fourthly power, fifthly formal institutional features, sixthly rules in use and finally culture.

Bounded Rationality

Bounded rationality is the first important concept of the conceptual framework of policy design,. Bounded rationality holds the idea that humans cannot act completely rational because they are not able to list all alternatives to a policy problem and are unable to predict every possible consequence (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968). In the case of Congestion Charging a decrease of these bounds as well as an increase of these bounds can be found.

First of all a clear decrease of the bounds of rationality can be found. This is evident when we look at the way GIS are used to calculate all the data gathered by monitoring road use and key traffic points. This is combined with the simulations made on where the zone should be. In this way it became very clear in which situation which costs and benefits would be reached in reducing congestion. Several zone borders where simulated and effects were calculated making sure those borders could be implemented which guarantee a maximum of effects.

Furthermore a decrease in the bounds of rationality can be found through the visualization of the application. Before the data were very difficult to understand for policy-makers in Transport for London now, while placing them in a map, it becomes easier to actually understand the consequences of implementing the zone in terms of effects and its impact on congestion.

On the other hand the bounds of rationality have increased. While simulations worked very well, the system of CCTV proved to be not 100 percent accurate but 90 percent at best. This made it difficult to understand consequences and calculate results of the application. Furthermore since the application was completely new consequences of implementing the application could not be predicted. Questions on what the impact for businesses in the zone and right outside the zone were could not be answered, also the effect of the exemptions were unknown and could have been a problem. As in all other case studies, the idea that the application is new makes sure the bounds of rationality increase since the consequences of the application cannot be predicted.

On the side of the citizens of London bounds of rationality only increased. Communication between Traffic for London and Londoners was poor. On the reasons for implementing the zone in a certain area, Londoners are still very confused on where the zone actually starts. They are completely unclear on why the zone is in place and where it actually is. This poor communication also made sure Traffic for London was unaware of the consequences in terms of public opinion when the charge first was imposed.

Satisficing

The concept of satisficing instead of optimizing (March, 1994) stems from these bounds of rationality. When one is not able to list all alternatives to a problem chances are that a perfect solution will not be found, therefore a policy-maker will often settle for a solution which is 'good enough'. This comes forward in the Congestion Charging scheme in several ways.

First of all in the sheer fact that congestion has not actually diminished, road use has diminished but the extra space has been filled with road works and extra busses. A decrease in traffic jams is not to be seen.

Another point in which especially the London council has settled for a satisficing solution is in the matter of the neighborhood issues. While it was calculated the zone should be at a certain point the social data of neighborhoods was not taken into the equation. This proved to be a problem but because the calculation showed this was the best alternative for the zone the council settled and accepted that neighborhoods where divided.

A third point where satisficing is clear is where the residents of London are concerned. Even though consequences of the zone were in the beginning not to be predicted now, since the zone was installed the London Council had to settle for some of the negative consequences. For example residents not being able to visit first class facilities, paying large sums to the Congestion Charge when going to work and businesses losing money. An optimal solution for reducing congestion without severe social consequences could not be found.

Another important point of satisficing is the financial costs of the Congestion Charge. It was not expected that the maintenance of the application, CCTV and the back office services would be so expensive. The original goal of the application was to make sure the money gained with the Congestion Charge would be reinvested in transport. This was not completely possible and the London Council together with Transport for London was forced to satisfice for this solution and settle for a situation in which the goal was not reached and promises where not kept.

A final point of satisficing is the case of the abolishment of the Western Extension. This is a point of satisficing primarily for Transport for London and the Labour Party. Where they wanted a London wide transport plan including the western extension, they had to settle for a situation in which the extension is now being abolished.

Conflict of Values

The third core concept in the conceptual framework of policy design is conflicts of values (Etzioni, 1967). In the case of Congestion Charging a number of conflicts can be found.

The most pressing conflict is the conflict on whether the charge should be implemented or not. The Labour party and Transport for London were very much in favor of the charge, the Conservative party and a large group of Londoners were not. The Conservatives claim the charge violates the freedom to travel and that it reduces the residents just outside the zone to second class citizens. Residents claim the charge to be an unfair tax. They did not want the charge to come into place to begin with. This conflict has not been solved. Even after promising to abolish the Western Extension still some actors are very much opposed to the charge in the central zone while the Labour party and Transport for London are still in favor.

A second conflict is to be seen in terms of effectiveness. The goals of the application are not met. The money gained with the charge is not reinvested into public transportation and better roads but is used for maintenance of the charge itself. Londoners as well as the Conservative party are very angry about this. Even though they did not approve of the charge to begin with, they feel lied to and are upset that promises are not kept. Often branding the Labour party and Transport for London as being liars and untrustworthy they claim an unfair tax is imposed on them with the purpose of maintaining the tax.

Another conflict is the conflict on whether the charge is a means for congestion reduction or for the environment. This came forward in the matter whether to increase the charge on heavy vehicles. Where the Labour party considered this a very good idea the Conservative party, with a large group of Londoners, supported by businesses was very severely opposed. It was claimed that now the Congestion Charge would become an environmental tax. Businesses were very worried since they are mostly the ones making use of heavier vehicles for transport. In the end, the Labour party gave in under public pressure together with the idea that too many exemptions would make the charge an administrative chaos.

A fourth conflict occurred when the debate started on whom to include in the discount area. The question revolved around whether the residents just outside the zone should have the right for a discount as well. The Labour party was opposed since it felt the whole point of the charge was to make sure people would not take their car into the zone and in that way congestion would be reduced. Giving everybody a discount who would possibly drive into the zone would not serve the purpose at all since with the discount they would be less inclined to leave their car and use public transportation. The Conservative party was very much in favor of this discount since they felt that the lives of these people where severely affected and their freedom to travel was violated. Additionally the Conservatives argued not everybody could use public transportation because of odd working hours, jobs which require a car or mothers with young children. On the basis of this they should be able, according to the Conservative party to live their life the way they used to and should receive a discount. In the end the Labour party agreed under public pressure that people who lived just outside the zone would get a discount, but only if they could prove their everyday life was severely affected. In practice almost none of the residents just outside the zone were actually able to prove this.

Furthermore there was a conflict on economic values, businesses were very much opposed to the charge, the businesses in the zone as well as the businesses outside the zone. Both were afraid of losing income. For the businesses in the zone the point was they would have to pay extra for deliveries of goods since the charge would be calculated in the price and they would lose the customers from outside the zone. For businesses outside the zone the point was that they would lose the customers from in the zone. The Conservative party aligned itself with businesses; Labour claimed the effects of the charge on businesses could not be proven.

Another conflict is family values. The Conservative party claims the charge to be anti-family, first of all because it hits families hardest, they are mostly car owners. Furthermore, the areas where most families live are just outside the zone but all first class facilities like healthcare, schools and maternity wards are inside the zone. The charge therefore, according to the Conservatives, makes sure that families are the ones to pay. On top of this the matter of dividing neighborhoods was added to this, making sure that a visit to grandma, or taking your family to church, became expensive. The Labour party disagreed and claimed public transportation could be used to visit all facilities. The Conservatives answer was: 'Have you ever seen a mother taking three baby strollers down the stairs in the tube?'

Power

Power issues, linked to the conflict of values are the fourth building block of the conceptual framework of policy design (Etzioni, 1967; Dahl, 1961). Actors use their power to push their solutions and ideas forward towards a policy design. When looking at the relative power of all the involved actors in designing the Congestion Charge scheme a number of things can be found.

First of all while at the time of the implementation of the charge the Labour party was in power and the Mayor, Ken Livingstone was a member of the Labour party they held a large deal of power. They decided on the charge and even though the Conservative party was opposed the charge was implemented.

The Labour party then delegated virtually all power and room for decision to Traffic for London to implement the charge. Transport for London had the power to decide where the zone should be located, which technology should be used, how the technology should be used and so further. Transport for London had almost complete power over all the details and had very little obligation to communicate this to the public.

This left all opponents of the charge almost powerless. The Conservative party was very much opposed but so were a large group of residents and businesses. Communication of details to these residents and businesses was poor and even though they protested with marches, blogs and websites and they formed resident groups and alliances, most of these were ignored.

The only time citizens actually had power to decide was on the consultation on the Western Extension. At first citizens did not believe they would be listened to. They were distressed they had to go through trouble to even obtain a questionnaire and they claimed questions were asked in such a manner they were directed towards a certain answer. They claimed Transport for London would do what they wanted regardless of the outcome of the consultation. This is correspondent with the reinforcement thesis (Kraemer & King, 1986). But in the end, the outcome was looked at and listened to and now the process is being started to abolish the Western Extension.

Another point in terms of power has to be made here. The entire calculations on where the zone would be were largely made by GIS experts. A lot of resident groups were very angry about this because they believed these decisions should have been made by civil engineers. They claim these neighborhoods are divided because computer experts have no experience in the field of transportation and have little knowledge of effects of measures in transportation. What we see here corresponds with Winner's hypothesis that because of the frequent use of computer technologies, power flows from bureaucrats and experts in the field towards computer technicians (Winner, 1977).

Formal Institutional Features

Moving towards the fifth core concept and looking at the structure side, there are the formal institutional features (Ostrom et al., 1994). These are the official laws and regulations. In the case of Congestion Charging the formal institutions had a very large impact.

Firstly because of the structure between the party in power and the party being in the opposition in Britain it was very easy for the Labour party to make legislation on the Congestion Charge. Even though large debates took place they still had the power to push the Congestion Charge forward even when the Conservative party was against the charge.

Another formal institutional feature which was very helpful in implementing and designing the zone was the fact that London has one organization for all transport issues:

an organization in which not only public transportation was organized but also road use, road maintenance and walker and cycler interests. This made one London wide plan for transport possible, integrating the charge into this plan.

Further more Transport for London was delegated almost all power to design and implement the charge, they did not have to answer to a large group of actors, and they had no obligation to communicate every detail. This being possible made sure the implementation and design of the congestion charging scheme could proceed quickly and smoothly.

Rules in Use

Next to the formal institutions the informal rules and codes of conduct are important; they can affect the process of policy design significantly (Ostrom et al., 1994; Stone, 1997). In the case of designing policy on the Congestion Charge this is the case as well.

Even though the rules in use have a large impact in this case we only see them on one occasion. Namely in the occasion in which Transport for London was delegated all the power to implement and design the zone. They had no past of inviting a lot of other actors to the negotiation table and were able to decide on all details by themselves without having to deal with opposition of other actors. A clear past of negotiation with a number of parties was not present and the normal way of interaction was thus not to invite others to the table. This made sure that implementation and design of the zone moved quickly and smoothly.

Culture

The final building block for the conceptual framework of policy design is culture (Ostrom et al., 1994). On culture a number of things have to be mentioned. First of all it must be mentioned the Londoners were very tired and fed up with the enormous congestion in London. A culture of decently waiting in line for your turn is even abroad considered to be British and is called queuing. Proverbs and sayings like: 'don't jump the queue' and 'be polite join the queue' are typically British. So even though queues are considered to be British the Londoners were very distressed over the large and long traffic jams in the city. This helped the installation of the Congestion Charge severely since people wanted something to be done.

Another point in terms of culture is that the Londoners are very much sensitive to the word tax. All forms of tax are questioned and debated and in most projects in the city it is publicly stated whether a project is paid with tax money and if so with which tax money. By naming the payment in the zone a charge instead of a tax the Labour party made sure the sensitivity regarding the word tax was bypassed. In a culture so sensitive of the word tax it was very helpful to name the charge 'charge' instead of tax.

Another point in culture that helped the implementation and design of the charge was the fact that London already had a large number of cameras installed for public safety. In other countries placement of cameras which photograph would be seen as a violation of privacy this point was never mentioned in London. People are so used to being filmed that a protest on the basis of violation of privacy was never the case.

There are also two points in culture hindering the design and implementation of the Congestion Charge. Firstly there is a culture in which issues are always much politicized. We see that in the culture present in London as well as in other parts of Britain that often an issue is directly made a political one where mostly Labour and the Conservatives both take the other side. This culture of politicization and polarization made sure in the case of the Congestion Charge a lot of opposition was present and an agreement on the charge could not be made.

The second point hindering the implementation and designing of the charge was a culture of protest. In London residents are very used to protest against a decision they do not approve of, an interest group is quickly formed. This custom of very quickly protesting against something made it possible for residents to very quickly start to protest against the congestion charging scheme. This obviously did not help a smooth implementation but it must be said that this did not hinder implementation severely either.

Summarizing this we can see the bounds of rationality have decreased on one hand. A decrease is to be seen in the way simulations are being made to view different alternatives. The visualization made sure the different alternatives could be easily explained. On the other hand an increase is to be seen, firstly since CCTV proves to be not as accurate as hoped. Furthermore since the application was completely new consequences of implementing the application could not be predicted. On the side of the citizens of London bounds of rationality only increased. In the Congestion Charging case satisfycing was more rule than norm. The application does not have the expected result and the reinvestment of money into transport was impossible. Also the fact that neighborhoods were divided had to be settled for. In terms of power and conflict we see that partially by the use of GIS relations have shifted. Firstly Transport for London was delegated with all the power to decide on the charge and the zone, leaving all other actors powerless. Since Transport for London was the only actor with the GIS and the data and results, they could decide on each detail without competition from others. The congestion charging scheme led to a lot of conflict, after implementation of the charge the conflicts where numerous, this can be explained by a much politicized culture. When looking at structure we see that for a large deal the structure benefits those in power. Where the Labour party and Transport for London already had a large deal of power since they had the information, the structure only reinforced this. Formal institutions made sure the Labour party had the authority to install the Congestion Charge, and that an organization as Transport for London was able to deal with all forms of transport. Also, Transport for London had no obligation to consult with other actors and to invite them to the negotiation table, giving Transport for London full power. Culture mostly helped those in power as well, Londoners wanted something to be done about congestion and by naming the charge 'charge' and not 'tax' the sensitivity around the word was bypassed. Two points in culture did not help, firstly a culture of politicizing each issue made sure the Conservative party spoke out against the charge. Secondly a culture of protesting made sure citizens quickly aligned themselves and organized protests.

12.4.2 The Influence of the Application on Congestion Charging

Now the core concepts of the conceptual framework of policy design have been filled in for the case of Congestion Charging the conceptual framework itself can be addressed. By using the three parts of the conceptual framework and the four channels of interaction the case of Congestion Charging can be analyzed.

When dealing with the conceptual model of policy design in the case of Congestion Charging we first need to deal with the first part, the action arena (Ostrom et al., 1994). This is the space in which all involved parties interact. There are several groups of actors in the policy design process on reducing congestion. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They then use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

We see there are several relevant actors in the action arena, first of all the Labour party, being strongly in favor of the charge. They where the ones to propose it and make legislation to implement it. Secondly the Conservative party who is very opposed to the Congestion Charging scheme is one of the actors. Furthermore there is Transport for London who was delegated the power to design and implement the congestion charging scheme together with a transport plan for London. Thirdly we see a number of already organized groups opposing the charge, such as the British Drivers Association and The National Alliance against Tolls. A number of groups that were organized ad hoc to oppose the congestion charging scheme are also present, mostly residents groups like the West London Resident Groups and the Chelsea Resident group. Another group of actors are the businesses located both inside and outside the zone, also being opposed to the charge. A last group of actors are the citizens not belonging to a group but being opposed to the charge. One could argue that citizens in favor of the charge should also be included but in the design and implementation process of the charge they did not try to exert any influence so they are left out. In terms of coalitions there are actually two coalitions, those in favor (the Labour party and Transport for London) and those opposing the charge (the Conservative party, organized groups, residents and businesses)

Furthermore all the coalitions in the action arena use their relative power to see their preferred policy alternative move forward towards policy design. The battle is between the two coalitions, the one in favor of the charge and the one opposed. After the coalition opposed to the charge lost the battle on the charge coming into place, different conflicts occurred on how the charge should be conducted, what exemptions to make, how to extend and so further. In each conflict the lines of conflict move around the same two coalitions which do not change of composition.

Within the action arena actors and coalitions opt for a satisficing solution, because time and resources are often lacking and they do so within the bounds of their rationality.

The second part of the conceptual framework of policy design deals with the characteristics of the technology. What we see here is the GIS running the background of the Congestion Charging scheme is primarily seen as a tool for calculation, simulation and visualization of where the zone should be, what the effects are and how to proceed with congestion charging. All involved coalitions agree on this but they value it differently. The coalition in favor of the charge sees this technology as a very helpful device, the coalition opposed sees the technology as a tool for implementing something they do not want to have. Both coalitions consider the technology trustworthy. Even though the two coalitions value the technology differently they do agree on the meaning of the technology, but not on whether the effects are desirable. Therefore closure on the meaning of technology has occurred.

When looking at the action arena the interactions within are influenced by three factors. This is the third part of the conceptual framework, the structure. Firstly there are the formal institutions (Ostrom et al., 1994). Because of the structure of the London Council and the organization of Transport for London and the possibility for the Labour party to give Transport for London control of almost all decisions the actions in the action arena are influenced severely. Because of the formal institutions none of the actors in the coalition opposed to the charge had the power to effectively exert influence and stop the Congestion Charge. This made the implementation and design of the charge very easy. A second factor deals with the rules in use (Ostrom et al., 1994). Here we see the same, because Transport for London did not have to invite a number of other actors to the negotiation table, opponents of the charge could not exert influence and implementation proceeded smoothly. Finally culture also helped the coalition in favor of the charge (Ostrom et al., 1994). Londoners were tired of the large traffic jams, cameras were already accepted and naming the charge 'charge' instead of 'tax' benefit the coalition in favor of the charge. On the other hand, a culture of very quickly politicizing issues and a culture of frequent protest on the side of citizens made sure the coalition opposed to the charge could have its voice heard.

After dealing with the three parts of the conceptual framework the channels of interaction can be looked at.

The first channel of interaction is the channel moving from structure to the action arena. The influence of this channel is described above.

Secondly there is the channel influencing the action arena by technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artifact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992). Here we see that all actors hold the same frame, and all believe the technology is trustworthy and will calculate what it is supposed to calculate. Everybody agrees the technology is primarily a device for calculation. It is believed however the tool is used by the coalition in favor of the charge to push the implementation of the charge forward. Closure on the meaning of technology has occurred.

This brings us to the third channel, the channel moving from technology back to the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992). This comes forward in the case of the Congestion Charge; here we see the technology is seen as a calculation device and it benefits those in favor of the charge, because they hold all the information. In the action arena this is indeed the case and the actors behave accordingly. The coalition in favor of the charge holds the relevant information on congestion, road use, zone borders and so further, leaving the other coalition powerless without information.

Finally the channel from technology to structure, after the actors in the action arena have shaped technology and closure occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). We see this in the Congestion Charge case as well, the technology is seen as a legitimate, trustworthy tool for calculation. Therefore laws based on the information gathered with the technology are trusted as well. Since Transport for London is the organization holding the technology they now have a large amount of power in the making of legislation. This also reflects on the rules in use, the rule that Transport for London does not have to consult with others is reinforced by the fact that they hold the technology. Culture in this case does not seem to be influenced as of yet.

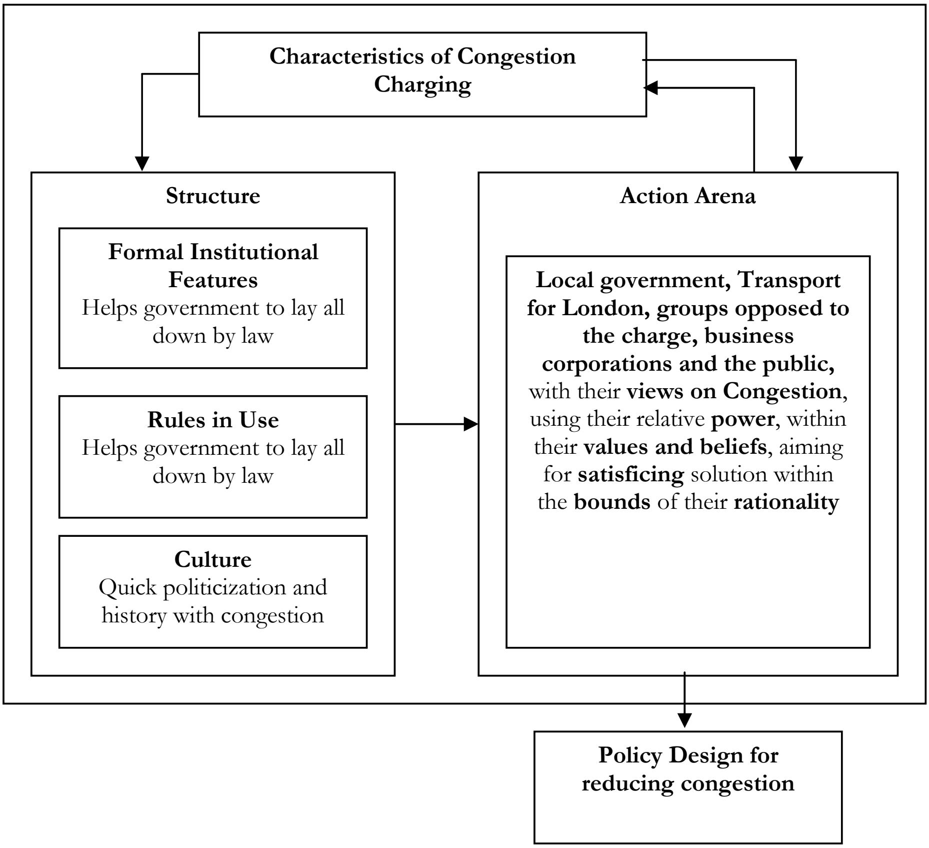

Figure 12.4: The Conceptual Framework of Policy Design

12.5 THE SECOND ARENA, DESIGNING THE APPLICATION

Finally in the last case the same can be found regarding the second arena emerging. Next to an arena in which policy is designed on reducing congestion and improving traffic in London there emerged a second arena. In this second arena the application used to calculate the zone and monitor the effects is the subject of policy design. How it should look and what it should do is discussed in this arena, while stakeholders opt for a policy design to their liking (Markus, 1983; Goodhue et al., 1992).

12.5.1 Designing the Application and Policy Design

Before moving to the conceptual framework of policy design, like above, first the variables taken out of the existing models, the building blocks of the conceptual framework of policy design will be discussed. Bounded rationality will be dealt with first, secondly satisficing, thirdly conflicting values, fourthly power, fifthly formal institutional features, sixthly rules in use and finally culture.

Bounded Rationality

The first building block is bounded rationality. Bounded rationality is the idea that humans cannot account for all possible alternatives, predict all possible consequences and refer to all possible costs and benefits (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968).

In the arena in which policy is designed on how to use the technology we can only see a clear increase in the bounds of rationality. In this arena the only question actors had to deal with is which technology should be used, would it be CCTV, Tag & Beacon, GPS with satellites or GSM technology. Transport for London was very clear on using CCTV while others claimed Tag & Beacon would be the best choice. Linked to this is the increase in the bounds of rationality since it was very unclear what the effect of each technology was, and how this technology should be implemented. For example, in the case of CCTV, should ANPR be integrated in the camera or not? At first it was not, later it was. Furthermore the costs of any of these technologies was unknown, what installation and maintenance would cost was unclear to any of the actors. In general in this arena it can be said the bounds in rationality were enormous, consequences were not to be predicted at all. A decrease in the bounds of rationality in this arena cannot be found.

Satisficing

The bounds in rationality add to the practice of satisficing instead of searching for an optimal solution (March, 1994).

For satisficing in this arena again the question of which technology to use pops up. A very clear case of satisficing is to be seen when Transport for London had to come up with a technology in very little time so the Congestion Charging scheme could be implemented. There was no time to evaluate all the technologies and Transport for London had to settle for a technology simply because time was pressing. The technology chosen had clear inaccuracies which were known to Transport for London but since they had to come up with a technology they settled for this technology. This also becomes evident when we look at ANPR which was originally not integrated into the cameras while this would reduce inaccuracies. Because of time pressure this technology could not be tested.

Conflict of Values

A third important concept, conflict of values can also be found in the arena of implementing and designing the GIS for the Congestion Charging (Etzioni, 1967).

In this arena we see different conflicts than in the arena to design the policy of reducing congestion and implementing the charge.

The first conflict was on which technology should be used. Transport for London wanted to use CCTV and ANPR a large part of the residents groups wanted to use Tag & Beacon. Transport for London wanted to use CCTV since the technology was proven and because Tag & Beacon would require people to buy equipment for in their car and fraud would be nearly impossible to detect. Those who were in favor of Tag & Beacon argued Tag & Beacon is supposed to have a much larger accuracy rate. Since Londoners are very angry about the accuracy rate of CCTV and ANPR they would very much like another application. Transport for London won the conflict, since they were the one who were supposed to decide. They have however, later on, explored the possibility of a Tag & Beacon application.

Another conflict is the conflict on whether the data of established neighborhoods should be in the GIS to make sure neighborhoods were not divided by the charge, a conflict between neighborhood coherency and effectiveness. Transport for London at first did not do so because they simply did not think about it, which aggravated citizens because they believed civil engineers would have thought about it. And later on Transport for London decided not to do so because the main goal is reducing congestion, also between neighborhoods, so adding neighborhood data in the application would by no means serve the goal.

Power

Linked to conflict of values, power is an important concept in the conceptual framework since it can be used by actors to push their solution forward over another actor's solution (Etzioni, 1967; Dahl, 1961).

When looking at the relative power of all the actors involved in the policy design arena of the technology itself we see a number of things, but these instances are very similar to what we saw in the first arena.

First of all Transport for London was delegated all power to design the technology and use it the way they saw fit. This left all other actors powerless.

Furthermore, this was delegated to Transport for London by the Labour party, in this way also holding power, and leaving the Conservative party with no means of influencing the process of designing the technology.

Citizens, businesses and organized groups being opposed to the charge had very little power if any. They were not asked for their opinion on the technology, also because the technology is very complex and it would be difficult to inform citizens on it.

Finally in terms of power we see that a lot of power in designing the technology and deciding what was to be taken into the technology in terms of data was decided by GIS experts. Formerly this was done by civil engineers taking more social and political matters into the equation. This corresponds with Winner's thesis which claims that technicians gain in power over governments while using technology (Winner, 1977).

Formal Institutional Features

Moving towards the structure side of the conceptual framework of policy design first of all the formal institutional features must be discussed (Ostrom et al., 1994).

When looking at formal institutional features we can see the same as in the first arena, the formal institutions helped a smooth and quick design of the technology. Since Transport for London had all the power to decide on the technology little discussion was possible and they used the technology as they pleased.

Rules in Use

Additional to the formal institutional features the informal rules are very important as well, the rules in use (Ostrom et al., 1994; Stone, 1997).

For the rules in use the same goes as for the formal institutional features since Transport for London did not have to debate their decisions on the technology with others it was very easy to design policy on the technology as they seemed fit.

Culture

The final building block is culture which influences the design process as well (Ostrom et al., 1994). In this arena there is not a lot of difference to distinguish with the first arena. Only the issue that issues tend to become highly politicized is important in this arena. The technology itself became a political issue with one group demanding Tag & Beacon and the other wanting CCTV.

Summarizing this we see there was an increase in the bounds of rationality. This increase is due to the fact that Transport for London had to choose a technology very quickly without knowing what the alternatives could offer. This brings us to satisficing, the problems and inaccuracies for CCTV were known but because there was no time to test other technologies, Transport for London had to settle for this technology knowing it was far from optimal. When looking at power and conflicts the same is to be seen as in the first arena, Transport for London held all power leaving other parties merely powerless, and again we see the flow of power towards computer experts. Only two real conflicts occurred in this arena, firstly on which technology to be used, Transport for London was in favor of CCTV and an interest group was in favor of Tag & Beacon. But since Transport for London had the power to decide, CCTV was implemented. Another conflict was the conflict on which data should be placed into the GIS. The question was whether neighborhood data should be included, in the end this was not the case since it would not serve the purpose of reducing congestion.

For structure we also see the same as in the first arena, formal institutional features and the rules in use made sure that Transport for London, delegated with the power to decide by the Labour party, had all power and could decide on all details.

12.5.2 The Influence of the Application in Implementing

After explaining the content of the building blocks, the variables for the conceptual framework of policy design, the case of designing the GIS for the Congestion Charge can now be looked at in terms of the conceptual framework.

As explained in chapter 6, as above, the conceptual framework of policy design exist out of three parts and four channels of interplay.

The first part consists of the action arena (Ostrom et al., 1994). This is the space in which all involved parties interact. Here we see that there are several groups of actors in the policy design process of the GIS for Congestion Charging. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They then use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

When looking at the different actors in the arena we see there are fewer actors than in the first arena. We do see the Labour party, being in favor of the charge and trusting Transport for London to design a proper application. There is also the Conservative party which is against the charge and does not feel comfortable with giving Transport for London this kind of power. A third actor is Transport for London, actually having the power to design the application. Finally we see organized groups, either ad hoc for the charge or general groups being against charging and tolls and drivers interest groups. The general public and businesses are not present in this arena; this can be explained by the fact that the technology is very complex and not visible for the public. In terms of coalitions there are two coalitions, one including the Labour party and Transport for London, believing Transport for London should be the one to decide on the design of the technology. Secondly there is the coalition with the organized groups and the Conservative party who believe that Transport for London should not have this power and would rather have a different technology design policy.

In terms of power we see the coalition with Transport for London holds all the real power. They were delegated with the power to design the application leaving the other coalition merely powerless.

The second part of the conceptual framework of policy design consists the characteristics of technology. Since in this arena mostly the same actors are present the same characteristics can be attributed to technology as in the first arena. Closure on the meaning of technology has thus occurred.

The third part of the conceptual framework of policy design deals with structure which influences the actions in the action arena. This structure is subdivided into three parts. Firstly there are the formal institutional features. (Ostrom et al., 1994) The formal institutions have made sure Transport for London had this kind of power to begin with. The formal institutions made sure conflict was limited since the other coalition had no real power to stop any design. Secondly the rules in use account for the same thing (Ostrom et al., 1994). Transport for London held all real leverage, making the other coalition to be unheard. For culture we see even though the issue is very politicized still the actions in the arena are limited in making sure Transport for London has a lot of say and other actors do not (Ostrom et al., 1994).

In the conceptual framework of policy design there are four channels of interaction which connect the three parts described above to one another.

Firstly the channel of the influence of the structure on the action arena, the content of this channel is described above.

Secondly there is a channel moving from the action arena towards technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artifact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992). We see here that closure on the meaning of technology has been established in the same way as in the first arena, namely that the technology is considered trustworthy but the measures taken after obtaining information from the technology are not approved of by all.

The third channel moves from technology back to the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992). This is not easily to be found in this case, even though closure on the meaning of technology has occurred it seems the technology itself does not interfere with the action arena severely. This is mostly due to the fact that the structure already laid down how interactions should proceed.

Finally there is the channel from technology to structure. After the actors in the action arena have shaped technology and closure on the meaning of technology occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). This is to be found, as soon as the technology was designed and established the law on congestion charging and tolls had to be adapted to the new technology making legally possible what Transport for London had designed. In the case of rules in use and culture little change is to be found.

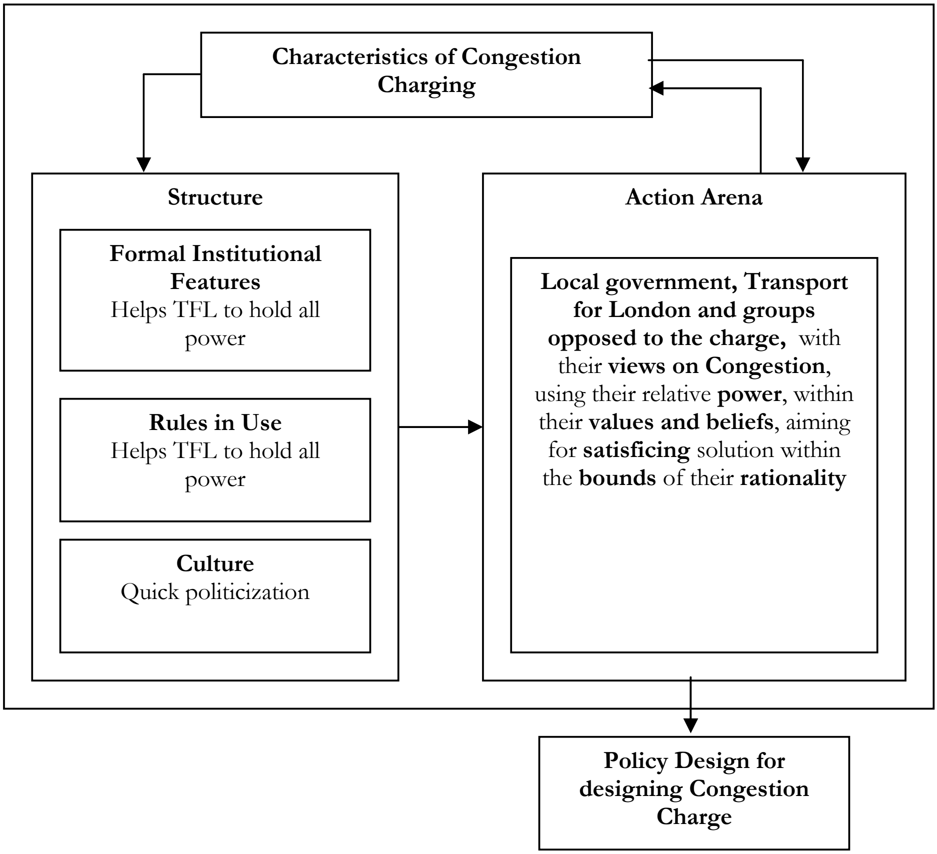

Figure 12.5: The Conceptual Framework of Policy Design

12.6 CONCLUSION

When coming back to the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?" first of all it must be concluded that when dealing with the influence GIS have we see that next to the arena in which the policy on reducing congestion is designed another arena arises simultaneously on how to design and how to implement the GIS used.

When we look at the influence of GIS in the Congestion Charge case in the arena of designing policy on reducing congestion a number of things can be concluded. First of all the applications for reducing congestion in London had an influence on policy design when looking at the qualities and effects of GIS.

First of all the data on congestion and road use has now been integrated into one database, making new information visible and making sure a decent overview can be given.

Secondly the calculation function of GIS makes it possible to make more effective policy since now different scenarios can be sketched on where the zone should be in order to create an effective policy.

Thirdly the quality of visualization GIS are said to have, prove to influence policy design in the Congestion Charge case. Through the simulations made of different alternatives on implementing the zone and by showing these alternatives in the form of a map, policy-makers at Transport for London understood what the consequences of each alternative were. Policy design could be based on those maps and visualizations.

An increase in communication can only be found within the organization of Transport for London. Through the maps they communicated in a way by which policy-makers could understand the different alternatives.

Finally for transparency it can be said GIS made sure to calculate all the data and show where key traffic points were and which roads were used often. With this data it became transparent what the problem was. The problem could be looked at from different angles, different solutions were also made transparent and on the basis of this new found transparency a policy design could be made. On the other hand transparency did not increase for citizens, they had no idea what was going on and were very confused on the exact location of the zone.

We also see the applications to analyze solutions for the congestion problem in London have another effect on the policy design process of reducing congestion, when looking at the conceptual framework.

The bounds of rationality have decreased on one hand but increased on the other. A clear decrease is to be seen in the way simulations are being made by GIS to view different alternatives on where the zone should be and what its effects would be. This made sure that a more rational decision could be made on the exact location of the zone. The visualization of these alternatives and effects also accounted for a decrease in the bounds of rationality making sure the different alternatives could be easily explained to policy-makers at Transport for London. On the other hand an increase is to be seen as well; firstly CCTV proves to be not as accurate as hoped for, this made the calculations less transparent as hoped. This accounted for an increase in the bounds of rationality. Furthermore since the application was completely new, consequences of implementing the application could not be predicted. Questions on what the impact for businesses in the zone and right outside the zone were could not be answered. These consequences were completely unknown, also the effect of the exemptions made were unknown and could pose a problem. As in all other case studies, the idea that the application is new makes sure the bounds of rationality increase since the consequences of the application could not be predicted. Thirdly on the side of the citizens of London bounds of rationality only increased, since communication between Traffic for London and Londoners was poor on the reasons of implementing the zone in a certain area. Londoners are still very confused on where the zone actually starts.

We also see that in the Congestion Charging case satisficing was more rule than norm. The application does not have the expected result and the reinvestment of money into transport was impossible. Also the fact that neighborhoods were divided had to be settled for together with other negative social consequences.

In terms of power and conflict, by the use of GIS relations have shifted. Firstly Transport for London was delegated with all the power to decide on the charge and the zone, leaving all other actors powerless. Since Transport for London was the only actor with GIS, the data and the results they could decide on each detail without competition from others; nobody else had the data. This made sure that those in favor of the charge where those to design the charge. The only time that others had power was in the consultation on the western extension. Even though citizens believed they did not have real power, the results of the consultation were taken seriously. Furthermore we must note that Winner's thesis (Winner, 1977) on the idea that power moves towards computer experts is clearly the case, where before civil engineers decided on transport matters, taking into account social data, now GIS experts do so.

The congestion charging scheme led to a lot of conflict. After implementation of the charge the conflicts where numerous, this can be explained by a politicized culture. Conflicts varied, for example: abolishing the charge or extending it; debates over the goals not being met and money not being reinvested; whether heavy vehicles should be taxed extra, which exemptions should be made for whom; whether the charge was bad for business; whether the charge was anti family and whether it was fair to divide neighborhoods and finally whether the charge was a charge or a tax.

When looking at structure influencing the action arena we see that for a large deal the structure benefits those in power in this case. The Labour party and Transport for London already had a large deal of power since they had the information, the structure only reinforced this. Formal institutions made sure the Labour party had the authority to install the Congestion Charge, and that an organization as Transport for London was able to deal with all forms of transport. Also, not only coming forward in the institutional features but also in the rules in use, Transport for London had no obligation to consult with other actors and to invite them to the negotiation table. This gave Transport for London full power. Culture mostly helped those in power as well. Londoners wanted something to be done about congestion and by naming the charge 'charge' and not 'tax' the sensitivity around the word was bypassed. Two points in culture did not help those in practice. Firstly a culture of politicizing each issue made sure the Conservative party spoke out against the charge and a culture of protesting made sure citizens quickly aligned themselves and organized protests.

We do see that closure on the meaning of technology has occurred; everybody trusts the technology and both camps agree that the GIS is a legitimate system to calculate effects, most agree on the outcome of these calculations and agree that with the road use the charge would have effect. The opponents of the charge just consider the measure taken after the calculations, being the charge, as illegitimate but not the application.

What is very interesting is that here again, next to this arena another arena emerged, the arena in which has to be decided on how to use the GIS at stake, the arena of the design process of the GIS application itself.

What we see here is there are fewer actors in the arena; citizens are completely left out. In this arena we only see an increase in the bounds of rationality; a decrease is not to be found. This increase is due to the fact that Transport for London had to choose a technology very quickly without knowing what the alternatives could offer. For testing there was no time. So they simply chose a technology they knew and was proven to operate, being CCTV with ANPR.

This brings us to satisficing right away, the problems and inaccuracies for CCTV were known but because there was no time to test other technologies, Transport for London had to settle for this technology knowing it was far from optimal.

When looking at power and conflicts the same is to be seen as in the first arena, Transport for London held all power leaving other parties merely powerless, and again we see the flow of power towards computer experts. Only two real conflicts occurred in this arena, firstly on which technology to be used, Transport for London was in favor of CCTV and an interest group was in favor of Tag & Beacon. But since Transport for London had the power to decide, CCTV was implemented. Another conflict was the conflict on which data should be placed into the GIS , the question was whether neighborhood data should be included. In the end this was not the case since it would not serve the purpose of reducing congestion.

For structure we also see the same as in the first arena, formal institutional features and the rules in use made sure Transport for London, delegated with the power to decide by the Labour party, had all power and could decide on all details.

After viewing the detailed conclusions above it is time to look at what this really means for the influence of GIS on policy design. The case of Congestion Charging leads us to conclude on three main points.

First of all this case shows us that implementation and the interactions in the second arena move very smoothly when one organization holds not only all the data but also all the power to decide. Transport for London had the power to decide on the Charge and also the means to do so: the data and the application. This made sure that institutionally all other actors were powerless. All the features of the application as well as the charge itself could be laid down by law very quickly without having to bargain with other actors. The fact that Transport for London is an organization which has the responsibility for a general transportation scheme, private and public, it had a monopoly on deciding. This tells us the institutional setting in which the GIS application is implemented and used can have a very large influence. In the case of Congestion Charging it made sure the entire charge could be dominated by one organization.

A second conclusion deals with culture. Fierce debates were held and if one was against the charge, one would be an active opponent. The British culture of politicizing issues very quickly made sure two opposing camps immediately emerged. Politics aligned themselves along the lines of these camps. The Labour party was in favor of the charge, the Conservatives opposed. The strong urge to politicize made sure each measure on the charge would become a matter of being in favor or being opposed. Room for a middle ground or consensus was not available. This caused for conflict on every decision which was to be taken after the charge was implemented. These issues included the western extension, discounts for residents outside the zone, heavy vehicles and so further. This shows us that politicization of the issue makes a consensus in policy design very difficult. A culture of politicization of issues therefore has a large impact on how the GIS is perceived and how policy is designed.

Finally there is something to be said on technology and GIS itself here. In the case of Congestion Charging the technology itself is sub-optimal. Results are poor, accuracy levels are relatively low and the costs of maintaining the technology are much higher than expected. Therefore the outcomes promised to citizens, less congestion and better roads and public transportation, could not be met. What this teaches us is that the choice for a certain technology can have its consequences. GIS is said to have a large number of positive effects but if the application does not fit, these effects will not occur. The case of Congestion Charging demonstrates GIS does not always prove to be the solution to any problem and the technology itself, after implementation, can be sub-optimal.

Chapter 13

Comparison

13.1 INTRODUCTION

In the previous chapters it was demonstrated what relevant theories on technology, agenda-setting and policy design were. On the basis of these a conceptual framework was constructed which was to be used to analyze the different case studies.

In these different case studies the influence of GIS has been demonstrated in different fields of agenda-setting and policy design. We have seen water management, the mapping of dangerous substances, contagious live stock diseases, urban planning, particulate matter concentrations and solutions to reduce congestion. Three of these cases have been conducted in the field of agenda-setting and three in the field of policy design. The cases are also different in territorial scale, where HIS and FLIWAS was researched on a national level, in the Netherlands and in lesser degree in Germany, the Riskmap was researched in the Netherlands with an emphasis on the provinces of North and South Holland. Contagious live stock diseases were researched on a national level in Germany with a specific interest for the state of Brandenburg; Virtuocity had a more local character and dealt with the Dutch cities of Helmond and Tilburg. Particulate matter was researched on a national level in the Netherlands with an emphasis on the province of South Holland. Finally Congestion Charging dealt with London and had a very local character.

Table 13.1: The Six Cases

	Sector	Policy Cycle
HIS and FLIWAS	Water management	Agenda-setting
The Riskmap	Internal risk management	Agenda-setting
TSN	Agricultural disease control	Agenda-setting
Virtuocity	Urban planning	Policy design
Particulate Matter	Air quality, environment, health	Policy design
Congestion Charge	Traffic	Policy design

Now the time has come to put all the individual cases together and see what the influence of GIS is on agenda-setting and policy design is in all the six cases. The aim of this chapter is to bring us further in answering the main question: "How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?" This will be done by comparing the six cases to one another on the basis of this question.

This chapter will be organized the same way as the chapters for the individual cases. First I will deal with the qualities and effects of GIS as demonstrated in the case studies. Secondly I will deal with agenda-setting, this encompasses the cases of HIS and FLIWAS, the Riskmap and contagious live stock diseases. As in the other chapters first the building blocks of the conceptual framework will be dealt with and after that the conceptual model itself. Thirdly, in paragraph 13.4 I will deal with policy design, these are the cases of Virtuocity, particulate matter and Congestion Charging. Here again first the variables of the conceptual framework will be dealt with and later the conceptual framework itself. Fourthly, as we have seen in each individual case study, a second arena occurs on how to design the GIS itself, this will be dealt with in paragraph 13.5. First the variables of the conceptual framework will be dealt with and later the framework itself. Instead of an overall conclusion at the end of this chapter after each section sub-conclusions will be drawn, relating to the main question.

13.2 QUALITIES AND EFFECTS OF GEOGRAPHICAL INFORMATION SYSTEMS

In order to compare the six case studies first the qualities and effects GIS are said to have will be looked at, for each case these will be contrasted. These qualities and effects will be the same as explained in chapter 2 and were dealt with in each case study individually.

13.2.1 Qualities and Effects

First the qualities of integration, calculation and visualization will be discussed and secondly the effects of improved communication and increased transparency will be dealt with. At the end of this section an overview of the qualities and effects are given in table 13.2.

Integration

First of all GIS are said to have the quality of integration (Bekkers & Moody, 2006; Lips et al., 2000, Bekkers et al. 2005; Hout & Bekkers, 1998; Greene, 2000). For integration we can distinguish between firstly standardization, the integration of work process within and between organizations and secondly the linking of datasets, the integration of different datasets into one dataset.

To start of with standardization, one thing stands out when looking at all the case studies. Namely, in some cases this has occurred and in others it has not. Standardization occurs only if one single application is used for all involved actors and the goal of the application is to integrate different organizations. Without these two premises standardization will not occur.

In the cases where standardization has occurred this can be attributed to the fact that firstly in these cases one single application was used for all involved actors. Secondly the application itself was used to integrate different organizations. We see this in the case of HIS and FLIWAS where the different organizations in the water sector now work with one application; in the case of the Riskmap the same is to be found as well as for contagious

Table 13.2: Qualities and Effects of GIS

	HIS/FLIWAS	The Riskmap	TSN	Virtuocity	Particulate Matter	Congestion Charge
Integration	Standardization successful, Linking datasets successful.	Standardization successful, Linking datasets successful.	Standardization successful, Linking datasets successful.	No standardization due to goal of the application. No linking of data sets due to the goal of the application.	No standardization due to no unitary application. Linking datasets successful	No standardization due to goal of the application. Linking data sets successful.
Calculation	Calculation present.	No calculation due to the goal of the application.	Calculation present.	No calculation due to the goal of the application.	Calculation present.	Calculation present.
Visualization	Visualization successful	Visualization successful	Visualization successful	Visualization successful	Visualization successful	Visualization successful
Communication	Communication between experts improved. Communication from experts to government improved.	Communication between experts improved. Communication from government to citizens improved.	Communication between experts improved. Communication from experts to government improved.	Communication between government and citizens improved.	Communication between experts improved. Communication between experts, governments and citizens improved.	Communication between experts and government improved.
Transparency	Transparency for the issue itself increased. Transparency for the policy problem increased. Transparency in the work process increased. Transparency in the process of implementation decreased.	Transparency for the issue itself increased. Transparency for the policy problem increased. Transparency in the work process increased. Transparency in the process of implementation decreased.	Transparency for the issue itself increased, but decreased due to insecurities. Transparency for the policy problem increased. Transparency in the work process increased. Transparency in the process of implementation decreased.	Transparency for the issue itself increased. Transparency for the policy problem increased. Transparency in the work process has not increased due to lack of integration and standardization. Transparency in the process of implementation decreased.	Transparency for the issue itself increased but decreased due to insecurities. Transparency for the policy problem increased. Transparency in the work process increased. Transparency in the process of implementation decreased.	Transparency for the issue itself increased. Transparency for the policy problem increased. Transparency in the work process has not increased due to lack of integration and standardization. Transparency in the process of implementation decreased.

live stock diseases. Standardization does not only occur in the work process but also in the way actors now all work together.

In the three cases where standardization has not occurred this can be attributed to the same two factors. Either not all involved actors work with the same application, or the application does not have the purpose to integrate organizations. In the case of particulate matter different GIS applications were used and in the cases of Virtuocity and Congestion Charging GIS were not used to integrate different organizations and were only used by organizations which were already involved.

The second part of integration is the integration of datasets into one set, making oversight and better and completer calculations possible. When comparing the cases it can be found that the linking of different datasets and generating new information will only occur if the goal of the application was to do so. In cases where the goal of the application is not to make new information visible by calculations or simulations or a better overview this will not happen since the application is not designed to do so.

In the case of HIS and FLIWAS all involved organizations have shared their data to make sure calculations and simulations can be made. In the case of the Riskmap all organizations now put their information in one application making sure a complete overview could be provided. For contagious live stock diseases it was demonstrated that by placing all data into TSN new information could be generated. Fourthly in the case of particulate matter the same happened, all information was combined and new information became visible. Finally for the case of the Congestion Charge it becomes clear that different information has been combined in a GIS making sure new relations could be found. Only in the case of Virtuocity this has not happened. The reason for this can be brought back to the goal of the application. In all cases one of the goals was to link information to one another, indeed to make new information visible, in the case of Virtuocity the goal was to present the existing information visible in a different way as traditionally.

Calculation

A second effect GIS are said to have is calculation, making difficult and complex calculations possible and providing for simulations (Bekkers et al. 2005; Bekkers & Moody, 2006; Moukomia, 2004). When comparing the six cases it becomes clear GIS is indeed able to do so but these calculations are not always seen as legitimate. It is important to note that calculation only occurs if the application had the goal to calculate. As above, the application needs to be designed to do so.

In the case of HIS and FLIWAS calculation possibilities are to be found to a large degree and are used as such. Different datasets are used to calculate damage, flood risks and evacuation. For contagious live stock diseases the same is to be found, all the information is used to calculate the risk of an outbreak but also the way to contain a possible outbreak.

In the case of particulate matter the same happens, effects of building plans are calculated in terms of air quality. Finally in the case of Congestion Charging different data was also combined to establish where the zone should be to guarantee a maximum effect.

Even though in all these cases calculation is present this does not mean that the calculations are trusted and seen as legitimate. In the case of contagious live stock diseases as well as in the case of particulate matter the calculations are seen as arbitrary and manipulated to serve one's own interest.

In two cases calculation cannot be found. These are the cases of the Riskmap and Virtuocity. In both cases this can be attributed to the goal of the application itself. In the other four cases the goal of the GIS was to use information to make calculations in order to predict and simulate, in both cases of the Riskmap and Virtuocity this was not the case. The goal of the applications was to visualize a complete overview in the case of the Riskmap or to present information in a different way as happened in the case of Virtuocity. For this was not the goal of the application, the application itself never had the capacity or possibility to do so.

Visualization

The third quality GIS are said to have is visualization, making very complex instances visible in a way the data is understandable to many people (Bekkers et al., 2005; Hamilton, 1996; Greene, 2000). Taking the six cases into account it shows that visualization is a core quality of GIS. GIS do indeed make sure that complex data can be viewed in a manner all can understand. Complex calculations can be presented in a simple way and integration of large datasets can be understood quickly.

This can be seen in every single case. In the case of HIS and FLIWAS difficult data could be presented in a way that all, citizens, experts and policy-makers could understand what it meant. This became even easier because all the data now had been integrated. The same happens in the case of the Riskmap, all data was integrated into one map making it possible for everyone to understand all the data in one blink of an eye. For the case of contagious live stock diseases the same goes, difficult calculations and large amounts of data are placed in one map for everybody to understand. In the case of Virtuocity it is demonstrated that people could 'experience' the new plans instead of looking at them via a maquette. Fifthly in the case of particulate matter it is seen that the visualization function is used to make complex information easy to understand in the form of a map. Finally in the case of Congestion Charge the same has happened. While all the information was placed on the map it became easy to understand what effects could be of the charge.

It must be noted here however, that in certain cases, like contagious live stock diseases and particulate matter the uncertainties in calculations are very much stressed, these uncertainties at this point are not visible on a map.

Communication

Next to qualities GIS are also said to have some effects, improved communication is the first of these effects (Bekkers et al. 2005; Bekkers & Moody, 2006; Haque, 1996). This improvement in communication is twofold. Firstly the communication between organizations of experts must be dealt with, secondly the communication between experts, governments and citizens.

When dealing with communication between experts it can be found that by using GIS, especially when integration and standardization have occurred, the communication improves. This makes sure all experts use the same language and are sure what the other is talking about. This was the case in the case of HIS and FLIWAS. By integrating all the different data from different organizations and making a structure possible in which all relevant organizations work with the same application communication became a lot easier. The case of the Riskmap demonstrates the exact same, because different organizations in the field now work together with one application communication moves more easily. For the case of contagious live stock diseases the same goes, except for those experts organized out of TSN. In the case of particulate matter this also happened. In the cases of Virtuocity and the Congestion Charge this did not happen, this can be accounted for by the fact that integration between different organizations has not taken place in these cases. Therefore there is no in- or decrease in communication between experts.

Next to communication between experts there is also the communication between experts, governments and citizens to be dealt with. It stands out here that GIS also improve communication from experts to governments, and if intended, also the communication towards citizens. This improvement is mainly due to the visualization function of GIS, presenting complex data in a simple manner. This improvement in communication helps policy design and agenda-setting in the way that issues are better understood.

In the case of HIS and FLIWAS communication between experts and the government has improved. Through the visualization function of GIS it could now be easily explained to governments what the issues at stake actually were and what relevant plans for policy could entail. In the case of the Riskmap communication between government and citizens was the main goal and this has succeeded. Through the visualization and integration of data the government was very able to communicate risks to citizens. The case of contagious live stock diseases demonstrates experts use GIS as a way, through the visualization function, to communicate with governments. In the case of Virtuocity we see GIS made sure communication between the government and citizens moved more smoothly. Plans for redevelopment became clearer. The particulate matter case shows us experts use the visualization function to communicate issues regarding particulate matter to the government. Since the data is often very complex through this way of communicating governments can understand what they are dealing with. Also the government uses the maps to communicate concentrations of particulate matter to citizens. This is not a large success, and citizens do not seem to understand what the variables on the map mean. Finally in the case of Congestion Charging it can be seen that the results of the calculations are not communicated to citizens. Communication between the government and experts has benefit from the use of GIS while a map could explain why the zone should be in one place and not in the other.

Transparency

The second effect GIS are said to have is increased transparency (Bekkers et al. 2005; Carver et al., 2000; Moukomia, 2004; Overchuk, 2004).We can distinguish between four types of transparency. Firstly there is the transparency in the policy itself: in terms of what is at stake. Secondly transparency in the policy problem must be dealt with: what is the problem and what are possible solutions. Thirdly there is the transparency in the work process. Finally we must deal with transparency in the process of implementing the application

When starting with the transparency in the issue itself the case studies show GIS account for an increase in transparency, mainly due to the visualization, calculation and integration function. Transparency at the same time can also decrease, this in is the case when the calculations are not being trusted.

In the case of HIS and FLIWAS transparency has increased very much by the possibility of making predictions and simulating events. It became very clear to governments and professionals what the effect of certain measures would be, because of the calculations, the integration of the data and the power to visualize. The case of the Riskmap shows us the same; because every risk is now integrated into one map and communicated, transparency on the location, nature and amount of risks increased. In the case of Virtuocity transparency increases while the plans for redevelopment became very clear and easy to understand for citizens as well as for the government. This can be accounted for by the visualization and communication effects of GIS. In the case of the Congestion Charge transparency has increased for the government and for experts, it became clear what the effect of the zone was. Through calculation and visualization transparency of these effects increased.

In two cases transparency has increased but has at the same time decreased. First we see this in the case of contagious live stock diseases. On the one hand transparency has increased, through calculation of scenarios and visualization of these scenarios it becomes clear what is actually going on. On the other hand the margins of insecurity of these calculations make sure transparency has decreased. For those experts who are organized out of TSN transparency has decreased significantly. Secondly this is to be found in the case of particulate matter. On the one hand because of the calculations it now becomes clear for government and experts what the effects on air quality of certain building plans are, so transparency is increased. On the other hand, because of the margins of insecurity within these calculations, transparency has decreased. Nobody knows what the outcomes mean and whether they are correct.

Secondly we must deal with the transparency of the policy problem itself and making it possible to look at a problem from different angles. Here the case studies teach us that GIS account for an increase in transparency for the policy problem itself and can help looking at the problem from different angles. This is mainly due to calculation, integration and visualization. If the calculations are not trusted however, this same transparency can decrease.

In the HIS and FLIWAS case this is apparent. The policy problem itself could be viewed from different angels by calculating effects of different measures. It became very clear what would happen if certain measures would be implemented instead of others. In the case of the Riskmap this is also the case, because of the integration of risks in one map the problem of for example where to build a school can be viewed from different angles since now all the information is available. In the case of Virtuocity it is demonstrated that through the visualization of the square any building problem could be looked at from different angels (literally) and in this way the transparency of the policy problem itself increased. In the case of Congestion Charge the policy problem itself became a lot more transparent. Due to the calculations made, the simulations done and the ability to visualize them transparency increased.

Here it can be demonstrated again that in the two cases in which calculations are not trusted transparency can increase and decrease at the same time. Firstly in the case of contagious live stock diseases. The policy problem becomes more transparent since the calculations can be made, but since they might be incorrect or insecure transparency decreases. The same goes for the case of particulate matter. The policy problem itself becomes more transparent since calculations can be made and therefore effects can be measured. On the other hand, these same calculations with their margin of error cause transparency to decrease.

Thirdly the work process can become more transparent as well by using GIS. This is only the case when integration has occurred; in these cases the integration into one application accounts for a higher degree of transparency in the work process.

This comes forward in several cases. Firstly the case of HIS and FLIWAS, because now all relevant organizations work together it is transparent who is doing what, in the logbook this can be recollected and transparency on this process has increased. In the case of the Riskmap this becomes clear while now all organizations can work together and information is available. The case of contagious live stock diseases also demonstrates the work process is more transparent, for those with access. Because all data are now in one application and everything which is done is logged in a logbook the process itself becomes more transparent. Finally in the case of particulate matter the work process has become more transparent as well. By combining all information into one application and setting a standard on how to deal with particulate matter concentrations.

In the case of Virtuocity and Congestion Charging this does not happen, the work process itself does not become more transparent. This can be explained by taking into account integration has not occurred in these cases and therefore the work process itself has not undergone any changes because of the use of GIS.

Finally we must look at transparency in implementing the application. Here we see that in all cases transparency decreased. This demonstrates the implementation of a new application, while using technology like GIS, accounts for a decrease in transparency on the side of governments in terms of the consequences of implementing the application. Since all the applications studied were new in their sort consequences could not be predicted.

In the case of HIS and FLIWAS we see that because of large uncertainties of what the impact of HIS and FLIWAS would be, the process of implementing was a process with large insecurities. In the case of the Riskmap transparency has also decreased in the process of implementation, since governments were unaware of the consequences of the Riskmap, they feared what would happen after implementation. In the case of contagious live stock diseases transparency decreased in the process of implementation as well. Consequences of whom to grant access were not to be predicted. In the case of Virtuocity it was demonstrated the government of Tilburg and Helmond had no idea how citizens would react and what the result of using GIS would be. The same goes for the case of particulate matter, the process of implementation caused governments to be completely unaware of what was going to happen. Especially when environmental organizations started to make their own calculations, transparency in this process clearly decreased The transparency in the process of implementation also decreased in the case of the Congestion Charge. The government was not sure how citizens would react and whether the plan would work to begin with.

13.2.2 Conclusions

When looking at the above it becomes possible to draw some conclusions. Firstly it is to be seen that the functions literature claim GIS to have, are mostly indeed present in practice.

Standardization does occur while using GIS, provided that all actors are given one single application and this application is designed to do so. This does account for an integration of different actors within a policy sector. The linking of datasets making new information visible is to be found as well. This can account for new policies based on the new information. This only occurs when the application is designed to make this happen. For calculation we see the same, it must be mentioned that the application needs to be designed to calculate. Furthermore, especially in the case of calculation it is important that even though the GIS is able to calculate this does not mean that the calculation, either the formula or the outcome, is trusted. While GIS are often used in complex matters, variables of a formula are often insecure or biased, this makes that the outcomes of these calculations do not always provide for a satisfactory base for policy. The function of visualization is present in all cases. The function seems to be inherent to GIS. It is demonstrated that this function helps policy-making to a large degree since difficult information, complex calculations and enormous sets of data can be viewed in a way for everybody to understand. This is linked to communication. Through the visualization function everybody can understand what the information means and an overview is possible. This makes communication from experts towards governments to become a lot easier. Where governmental actors often were unable to grasp the graphs and tables presented; now they understand. This goes for communication to citizens as well. Furthermore communication between experts has improved through the integration function, all work with the same application and speak the same language. This helps policy design and agenda-setting to a large degree. The case with the function of transparency is twofold. Firstly we see a clear increase in transparency using GIS, the issue becomes clearer to all actors because of the functions of visualization, calculation and integration. The policy problem itself can be looked at from different angles because of these same functions. The work process can become more transparent in the cases in which integration has occurred. On the other hand the use of GIS can account for a decrease in transparency. Firstly this happens when the calculations are not trusted transparency decreases because nobody understands what the outcome actually means. Secondly, when implementing the application transparency does decrease as well. This because the application is new, governments are unsure on the consequences the application is going to have. This cannot be attributed solely to GIS since this would be the case for any new application.

Even though here it is demonstrated these functions and effects are largely present this does not mean they will always occur. We see that the functions GIS are said to hold do not always come forward. The presence of these functions is partially based on how the application is designed. The goal of the designer, whether initiated by the designer or by someone else, is partially responsible for which functions the application actually holds and presents. It is too easy to claim GIS will always account for these functions and effects without taking in the programming of the application itself. This comes forward within several functions. Firstly in the function of standardization, standardization only occurs if the application was designed to standardize and invite all involved organizations to the application. An application only designed to be used in one organized does not have the ability to standardize. Secondly this comes forward in the function of integration, only an application programmed to integrate different other applications will actually do so. Thirdly this is present in the calculation function, an application designed without the possibility and the software to calculate will naturally not calculate.

This means in terms of agenda-setting and policy design that these two processes can be altered by the use of GIS. The course of the process can change because of the simulations, new information, integration, improved communication and increased or decreased transparency. The content might change as well due to these functions, especially the generation of new information, citizens input through democratization, new insights because of visualization and improved transparency and communication or more accurate calculation. Logically the outcome of these processes might change as well through these functions. Below it will be elaborated on how these processes change in practice and what this means.

13.3 SETTING THE AGENDA

After looking at the qualities and effects GIS can have and have had in the case studies, and the influence this can possibly have on the process of agenda-setting and policy design it is now time to look at these processes. First, in this section agenda-setting will be looked at Here it will be looked at what the influence of the perception of GIS is on the course, the content and the outcome of the process of agenda-setting. The three cases dealing with agenda-setting, HIS and FLIWAS, the Riskmap and contagious live stock diseases will be compared with one another in order to come closer to answering the main question.

13.3.1 Concepts of Agenda-Setting

As in the case studies first the building blocks of the conceptual framework will be dealt with before moving forward to the actual conceptual framework of agenda-setting. First mobilization of bias will be dealt with, next conflict of values and power, fourthly formal institutional features, next the nature of the issue and finally the policy window. An overview of each case is given in table 13.4.

Mobilization of Bias

The first building block of the conceptual framework of agenda-setting is mobilization of bias. This is the way some issues are organized into politics and some are organized out. In this way the system works in the favor of some and to the disadvantage of others (Bachrach & Baratz, 1970; Cobb & Elder 1972; Douglas & Wildavsky 1982; Schattschneider, 1960).

When comparing the three cases of agenda-setting it becomes clear that GIS can, by granting one access over the other, make sure some interests can be mobilized and others cannot. With the functions of calculation, visualization and communication, information becomes clearer and can be used to the advantage of some actors over others. The use GIS therefore attributes to the process of mobilizing bias. The actors with access to the data and the application have a clear advantage in mobilizing bias. In some cases this does not happen. This can be attributed to a lack of interest in the subject; there are no sentiments to be mobilized.

When backing this with the information from the cases studies it can be seen that in two of the cases it can be demonstrated that the use of GIS attributes to the process of mobilization of bias. In the case of HIS and FLIWAS this comes forward because of the simple visualization in a map and in movies, and the communication of this to policy-makers, water management is understood better and they are more easily mobilized. Another point where mobilization of bias comes forward is while some want the public to know about the flooding risks and thereby expand the water issue; others do not think this to be a good idea.

Also in the case of contagious live stock diseases mobilization of bias is to be found. The most prominent instance is where some actors have access to TSN and others do not. Another instance where mobilization of bias clearly comes forward is in the debate on which organizations should have access to TSN and how far TSN should be expanded. Finally we see mobilization of bias back in the application itself. The application is programmed so some solutions and measures are preferred above others. Since the margins of insecurity in the calculations are very high these margins of error can be used to make one outcome look better than another outcome.

In the case of the Riskmap GIS does not attribute to this process of mobilizing bias. At first municipalities were very afraid the Riskmap would give citizens the power to complain about any potentially dangerous issue. Now all issues are now clearly visualized and communicated to them, this turned out not to be the case. While mobilization of bias in theory is very much present in the case of the Riskmap in practice it is not to be found in the relationship between citizens and government. Citizens seem to be uninterested in mobilizing for the sake of potential dangers in their surroundings and therefore do not. For professionals and different layers of government the same is to be seen. In terms of mobilization of bias little in practice is to be found. The case of the Riskmap itself does not seem to serve to the advantage of one group and consequently to the disadvantage of another group.

Conflict of Values

The second building block in the conceptual framework is conflict of values (Bachrach & Baratz, 1970; Kingdon, 1995; Sabatier, 1993). When looking at the case studies it stands out that the use of GIS can account for a number of conflicts in values. These conflicts mostly occur in terms of access to information, content which should be dealt with, legitimacy of the outcomes, the use of the application for one's own agenda and privacy.

When looking at the case studies individually this first comes forward in the case of HIS and FLIWAS. Where the water management professionals would like to inform as many people as possible others do not. Secondly the public does not hold the belief water is that urgent. They have the feeling the government has taken care of water management and they have nothing to worry about in terms of flooding.

In the case of the Riskmap everybody seemed to agree from the beginning onwards on what the Riskmap should be. The government had to balance some between keeping the Riskmap accessible to many and to make it complete. A conflict occurred on the affect-distances. The provinces and the municipalities felt very strongly they should be visible. It turned out that they would not be on the public map. Secondly we can see that while all parties agreed on the idea that the Riskmap should be made there was some fear that terrorists would use the information on the Riskmap. This fear was quickly laid off when everybody realized that terrorists could always find this information otherwise; it had always been open to the public.

Finally for contagious animal diseases some conflicts can be found, firstly the belief of some that others should be organized out of TSN, since they would not be relevant actors. A second point where values and beliefs are concerned is how far to expand TSN. A third conflict deals with the legitimacy of the application. While policy-makers and those who have access to TSN are convinced of the added value, others believe this not to be the case. They question the calculations; while the data might be up-to-date the calculations hold a large margin of error. Linked to this is the belief that some could use TSN for their own agenda, by programming the calculations one could automatically make sure some measures will come out better than others. A final value that needs to be mentioned in the case of TSN is privacy and the right to run one's own business. Farmers fear that TSN will cause even more rules and will eventually force them to provide even more information on their farm.

Power

Power, another relevant concept in the conceptual framework of agenda-setting, is also one of the factors in reaching agenda status for an issue. An issue backed with more power is far more likely to reach agenda status than an issue that is not (Bachrach & Baratz, 1970; Sabatier, 1993; Dahl, 1961).

In the three cases which deal with agenda-setting it stands out that GIS, through their functions and effects of calculation, integration, visualization and communication, account for a shift in terms of power. Those with access to both the data and the application clearly gain in relative power. Either because they have information others do not or because they are the only ones able to make simulations and calculations. Furthermore they are able to use the application to communicate their plans in a way everybody can understand. In some cases this shift goes so far that experts in the field are making decisions formerly made by politicians.

Taking this back to the cases it can be found that in the case of HIS and FLIWAS the applications helps giving the water management professionals more power within the sector compared to before. Communication to policy-makers improved, datasets are linked and calculations made. Another reason is that the water management professionals are the ones with the information, where this formerly was more dispersed between different organizations now it is centralized in FLIWAS. While local and provincial governments still have their share of power, they, by the use of HIS and FLIWAS, have to move some over to water management professionals.

In the case of the Riskmap there is little movement of power from one organization to another. There are a lot of instances in which the Riskmap gives an organization or a group of citizens increased power but it is not used. First of all we see through the usage of the Riskmap citizens are given a larger deal of power. They now have the power to complain about dangerous situations, but they do not. We also see that through the Riskmap and especially because all risk are linked to the permit given by the municipalities citizens as well as other layers of government can hold the municipalities accountable for making sure regulations are applied properly. Again we see that this does not happen, not only because citizens are uninterested but also because the layers of government anticipate this and make sure permits are correct before risks are placed on the Riskmap. The position of the first aid agencies has improved, because of the Riskmap they are more and more asked to join in negotiations regarding risk management, although, as well as other parties, they do not execute this power fiercely.

For the case of contagious live stock diseases the variable of power is clearly present. First of all this can be seen in the shift of power from policy-makers to experts in the field of contagious live stock diseases. Where some choices were made by elected politicians before the use of TSN, now with the calculations and the up-to-date data these choices are made on the basis of outcomes of calculations made by TSN and experts. Even though the margins of insecurity are very high, still the outcomes are regarded by policy-makers as a rational, correct calculation based on hard numbers. This also has something to do with the visualization function. Now experts are very able to explain very specifically to policy-makers what should be done. We also see experts on contagious live stock diseases are divided into those with access to TSN and those without. Those without access cannot do any relevant and up-to-date research any more. The power of the experts therefore has moved to one group, those with access, leaving the other group powerless. Furthermore TSN itself according to some is a source of power, the access to the application makes sure one can push issues forward.

Formal Institutional Features

On the structure side of the conceptual framework firstly the formal institutions come into play, they form the fourth relevant concept in the framework of agenda-setting (Bachrach & Baratz, 1970; Sabatier, 1993).

It becomes clear when looking at the case studies that the formal institutions can both help and hinder agenda-setting while using GIS. In cases in which the application was laid down by law the application helps agenda-setting, since the involved actors obtain the right to voice their opinion. In the cases where the application was mostly initiated by the sector itself the formal institutions seem to hinder agenda-setting. The application is not embedded in the formal institutions so the actors working with the application are legally not granted any power.

In the case of the Riskmap its content is very clearly defined by law and regulations. There is little possible on the legal side of the Riskmap in terms of agenda-setting. Because of the new laws, the municipalities now have a very clear obligation of informing their citizens on potential dangers and risks. Because of this obligation it is also to be seen that municipalities as well as provinces can be held accountable for how they treat the risks on their territory. This could put issues on the agenda as well, as happened with the gas stations and the complaints of citizens on permits which were not renewed in time.

In the case of contagious live stock diseases it can be said the formal institutions had a large impact and helped agenda-setting. Now and in the past there always have been an enormous amount of rules and regulations, nationally and European, on contagious live stock diseases. The way prevention and containment is organized is so much formalized there is no possibility of getting it on the agenda any other way. This has to do with the large impact live stock diseases have on the economy, since they can affect the economy severely formal rules are laid down. This helps agenda-setting severely, the fact live stock diseases have always been on the agenda, and the enormous amount of rules make sure they stay on the agenda. Attention for live stock diseases, at least on the side of policy-makers does not fade.

In the case of HIS and FLIWAS this is not always the case. When the initiation of the application is not formalized by formal institutions the existing institutions and laws might hinder the agenda-setting power of the application. In the case of HIS and FLIWAS it can be said that the formal institutions hinder agenda-setting for two reasons. First of all the water management sector itself is very much fragmented and dispersed. It becomes difficult for water management professionals to organize themselves and become a dominant partner in agenda-setting negotiations, since they are often all looking at different issues they cannot make themselves a powerful group. Secondly it is so that often water management professionals are not included in negotiations on plans. In this situation, therefore they do not have the chance of placing their issue on the agenda or prevent another spatial planning issue to be discussed.

Nature of the Issue

The second concept on the structure side of the conceptual framework of agenda-setting, the nature of the issue, as opposed to the content, forms the fifth important variable in the conceptual framework of agenda-setting. Where the content deals with what the case is actually about the nature deals with five dimensions of the case by which expansion to a relevant public can be explained, and expansion to a larger public, according to Cobb and Elder, would ensure agenda-status (Cobb & Elder, 1972).

When looking back at each case study we can see here that the use of GIS could help issues to expand more easily on the fourth dimension, complexity versus simplicity. Through the visualization function the issue become simpler. Furthermore it seems that GIS are generally used for concrete, general, long term and routine issues. This would make the issue difficult to expand. The reason for this is the time consuming and costly nature of designing a GIS application. But the nature of the issue itself does not seem to attribute to a direct influence GIS could have. This can be explained by the idea that the theoretical notion of the nature of the issue is meant to be used in media studies. The nature of the issue might not be appropriate to be used in researching issues of agenda-setting which do not deal with agenda-setting practices done by other organizations than the media.

When backing this by the case studies we see that in the first dimension, the dimension of concreteness versus abstractness, HIS and FLIWAS move to the side of concreteness. The issue is unambiguously and not very abstract. For the Riskmap we see the same as well as for the case of contagious live stock diseases. This should not make the issue expand easily.

In the second dimension, the dimension of general versus specific, HIS and FLIWAS move more towards general, it is not very specific or peculiar; this will make it expand more easily. The issue of water and thus HIS and FLIWAS affect a lot of people. A very specific issue does not and only affects a few. For the Riskmap the same goes, as well as for contagious live stock diseases. In all three cases this should help the issue to expand.

The third dimension deals with the time span of the issue, short-term versus enduring. Here we see all cases deal with the long run, which should help them expand easily, since people are willing to commit to long term issues.

In the fourth dimension, complex versus simple we see that for HIS and FLIWAS the issue is very complex. Water management has always been a very technical issue, now by using HIS and FLIWAS and using its visualization function, the issue becomes a lot simpler to understand. Where complex issues do not expand quickly, HIS and FLIWAS can make sure the complexity reduces and the issue will expand more easily. For the Riskmap the situation is different, it is fairly simple; the locations of the risks are clear and easy to understand for many. This simplicity increased because of the visualization function of the Riskmap. Before using the Riskmap this issue was very complex, information was dispersed and very technical. Where complex issues do not expand quickly, in the case of the Riskmap this should expand easily. In the case of contagious live stock diseases the issue is very complex, the large amount of rules and regulations make it difficult for people to understand what is allowed and what is prohibited. Also the nature of animal diseases and containment is very difficult, the calculations are hard to explain and a large number of variables are involved. This would also make the issue difficult to expand.

Finally on the fifth dimension of routine versus extraordinary issues we see that water management has been an issue in the Netherlands for decades and more. Therefore it will gain less attention than a new or extraordinary issue. For the Riskmap the same goes as well as for contagious live stock diseases.

Table 13.3: The Cases and the Dimensions of the Nature of the Issue

	HIS and FLIWAS	Riskmap	TSN
Concrete vs. abstract	Concrete	Concrete	Concrete
General vs. specific	General	General	General
Short-term vs. enduring	Enduring	Enduring	Enduring
Complex vs. simple	Complex	Simple	Complex
Routine vs. extraordinary	Routine	Routine	Routine

Table 13.4: Variables of Agenda-Setting

	HIS/FLIWAS	The Riskmap	TSN
Mobilization of Bias	Present through functions of visualization, communication and calculation. Also because of matters of access.	Not present due to the lack of interest and because the Riskmap does not serve one's interests over someone else's.	Present through functions of visualization, communication and calculation. Also because of matters of access.
Conflict of Values	Conflict in terms of accessibility	Conflict in terms of accessibility and content	Conflicts in terms of accessibility, legitimacy, use for own good and privacy
Power	Shift from local and provincial governments to water management experts because of access to information, integration, communication, calculation and visualization.	Shift of power from local governments to citizens because of access to information, integration, communication and visualization but this power is not executed. This is due to lack of interests on the side of citizens and anticipation of the local governments	Shift from government to experts because of access to information, calculation, visualization and communication.
Formal Institutional Features	Formal institutions hinder agenda-setting for the water sector is dispersed.	Formal institutions help agenda-setting because the formal institutions initiated the Riskmap.	Formal institutions help agenda-setting because the formal institutions initiated TSN.
Nature of the Issue	Concrete, general, enduring, complex and routine.	Concrete, general, enduring, simple and routine.	Concrete, general, enduring, complex and routine.
Policy Window	HIS and FLIWAS accounted for the opening of a policy window.	The Riskmap accounted for the opening of a policy window, but the opportunity is poorly used.	TSN accounted for the opening of a policy window.

Policy Window

The last important concept in the conceptual model of agenda-setting is the policy window. This is the opportunity for actors to push their issue forward (Kingdon, 1995). In the case studies it stands out that GIS itself, after implementation, can cause a policy window to open. Because of the new possibilities, calculations, new information and visualization an opportunity arises for actors to push their idea forward towards agenda status.

In the case of HIS and FLIWAS due to the integration of different organizations, the integration of datasets, the calculations and simulations and the possibility to visualize these data, an opportunity arises in which water management issues can gain agenda status. Ideas are more easily communicated because the water management sector can act as one block and is able to visualize the information in an understandable way.

In the case of the Riskmap the same has happened, because of the design and the implementation of the Riskmap the opportunity opens to deal with dangerous substances in a new way. Even though in practice this has not happened yet it becomes possible for actors to demand issues on internal risks to be addressed. This became possible by the visualization of these risks and by the integration of datasets making the information complete.

For contagious live stock diseases the same goes, because of the new information, and the possibility of scenario sketching an opportunity arises to place new issues on the agenda. Since communication improved, standardization and integration have occurred and because of the calculations and the possibility to visualize complex data a policy window opens.

13.3.2 The Influence of GIS on Agenda-Setting

After looking at the variables making up the conceptual framework of agenda-setting, the building blocks so to say, now the conceptual framework of agenda-setting can be looked at.

As mentioned in the case studies the conceptual framework of agenda-setting consists out of three parts and four channels of interplay. First the three parts will be discussed since these three parts are very case specific they cannot be compared, therefore they will only be discussed for the means of overview. The four channels of interplay can be compared and will be discussed. An overview of the comparison will be given in table 13.5.

The Policy Sub-System

In the policy sub-system (Sabatier, 1993) the different advocacy coalitions function within their technological frame. This frame holds their beliefs, expectations and assumptions on the technology (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995; Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). Furthermore all the actors in the policy sub-system use their relative power to gain agenda status for their issue (Bachrach & Baratz, 1970; Cobb & Elder, 1972).

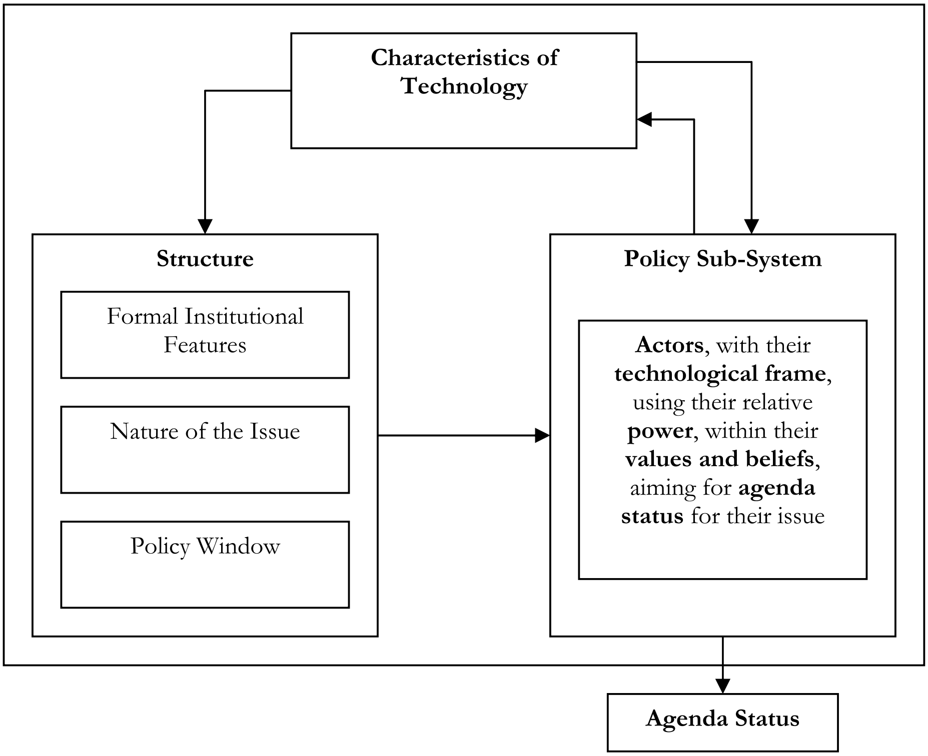

Figure 13.1: The Conceptual Framework of Agenda-Setting

In the case of HIS and FLIWAS the water management professionals in all actors perceptions now have a large deal of power. Especially because now with HIS and FLIWAS they can communicate the information they own much more easily. Also we see that most of the conflict within the policy sub-system occurs between the water management professionals and the local authorities.

In the case of the Riskmap the public holds a large deal of power, as perceived by all actors, even though they do not execute this. There is no clear power struggle visible in the Riskmap and extreme shifts in power are also not to be found. All coalitions in the policy sub-system seem to more or less agree with one another on major lines and real power is never executed.

In the case of TSN the position of the experts with access to TSN has improved at the expense of other experts, policy-makers and farmers. The experts with access to TSN have the power to place contagious animal diseases and new measures on the agenda and they do as such, in a very successful manner. These experts seem nationally, and European, very able to keep contagious animal diseases a hot item on which money is spend. The other actors, losing power, are not very pleased with this and do not have the power to gain agenda status for any issue they deem important. The national government as well as the

European government tends to listen to those with access to TSN since they are the ones with the accurate data.

Technology

The second part of the conceptual framework for agenda-setting deals with the characteristics of the technology. Here it is important which meaning GIS have been given and whether closure on the meaning of technology and stabilization have occurred (Bijker, 1995).

In the case of HIS and FLIWAS these applications are perceived by the water management professionals as a tool primarily for calculation and visualization, the policy-makers perceive it primarily as a tool for visualization and communication. While both agree that all these functions are apparent within HIS and FLIWAS the emphasis between the two are different. Stabilization has occurred, meaning that within the groups everybody agrees on the meaning of HIS and FLIWAS but that closure on the meaning of technology, a general acceptance between groups of what HIS and FLIWAS actually are, has not yet reached its ending. Even though all groups agree on the functions HIS and FLIWAS provide for, where the emphasis should lie is a matter of difference.

In the case of the Riskmap a consensus between all organizations can be found. Everybody agrees the Riskmap is a mean of communicating risks and of making these risks transparent and clear to all involved parties. There has been no discussion from the beginning onwards on what the Riskmap should be, closure on the meaning of technology has occurred right away without any arguing.

In the case of TSN not all parties agree on what TSN actually entails. Those with access but also policy-makers and politicians agree that TSN is a tool for up-to-date information and is very valuable in making calculations and simulations so policy can be made. Others believe TSN to be a tool for exclusion; those working in the food chain believe they are excluded but other actors within the field of live stock diseases feel so as well. Furthermore, some believe that TSN is used to push ones own ideas forward, since the application can be manipulated. Closure on what TSN is therefore has not occurred, it is not the case that all agree on the meaning of TSN. Additionally, stabilization has not occurred either, even within groups there is disagreement on whom to include, which topics to include and how far to expand TSN.

Structure

The final part of the conceptual framework of agenda-setting is structure. This structure consists of three parts influencing the policy sub-system. First there are the formal institutions(Bachrach & Baratz, 1970; Sabatier, 1993). In the case of HIS and FLIWAS the formal institutions hinder the water management professionals to push their values forward, and in that way benefit the local authorities. Even though the use of HIS and

FLIWAS make this hindrance lessen. In the case of the Riskmap the formal institutions help citizens to push their ideas forward in making an agenda-point. These formal institutions also help provinces and municipalities to do so, so agenda-setting from either the side of citizens as well as the side of government is helped by the formal institutions. In the case of TSN the formal institutions help agenda setting severely. Since everything in contagious live stock diseases is so much formalized and deals with an enormous number of rules and regulations, the issue simply stays on the agenda, not only because the fear exists an outbreak will occur but also because so much money is involved.

Secondly the nature of the issue influences the sub-system (Cobb & Elder, 1972). In the case of HIS and FLIWAS it was already claimed that on the basis of the nature of the issue it is impossible to give a unambiguous answer to whether water issues will expand easily. It must be said however that by using HIS and FLIWAS the issue itself became less complex and therefore easier to expand. In the case of the Riskmap the nature of the issue, as explained, would help the issue expand in theory, in practice this does not happen. Although it must be said that while the issue is simpler now in the future this issue might expand very rapidly. In the case of TSN while the nature of the issue, would neither help nor hinder the issue to expand in theory, in practice the issue does expand on the governmental level. More departments deal with contagious animal diseases than before but the issue does not expand to the public since the public does not seem to be interested.

Finally the policy window plays a large part (Kingdon, 1994). In the case of HIS and FLIWAS these applications accounted for an opening for a policy window by adding new possibilities. There is no situation in which water management professionals can push their ideas forward very easily, this benefits the local authorities to a large degree. In the case of the Riskmap the existence of the Riskmap accounts for the opening of the policy window as well, because of the available technology and the simple overview a window has been opened through which citizens, organizations and governments can push their ideas forward. Finally for TSN the same goes, the existence of TSN accounted for new solutions and problems in the field of contagious live stock diseases, making sure an opportunity for them to be pushed forward is present.

Channel from Structure to the Policy Sub-System

After dealing with the three parts of the conceptual framework now the four channels of interplay can be dealt with. Firstly there is the channel moving from the structure to the policy sub-system. It is assumed that the actions in the policy sub-system are influenced by three factors, first the formal institutions, the nature of the issue and the policy window. The structure can both hinder and help agenda-setting and is partially dependent on the use of GIS.

When looking at the case studies in this channel three things stand out. Firstly the actions in the policy sub-system can be hindered or helped by the formal institutions, dependent on whom initiated the design of the GIS. When the initiation lies with the government the formal institutions help the initiators. When initiation lies with the sector itself the formal institutions do not since the expert's power is not embedded in the formal institutions. In the case of HIS and FLIWAS the formal institutions hinder the scope of action possible in the policy sub-system since HIS and FLIWAS are not embedded in the structure. In the cases of the Riskmap and TSN however, this is not the case. In the case of the Riskmap formal institutions help citizens to push their ideas forward in making an agenda-point, these formal institutions also help provinces and municipalities to do so. In this way agenda-setting from either the side of citizens as well as the side of government is helped by the formal institutions. In the case of contagious live stock diseases we see the formal institutions help agenda-setting, since everything in contagious live stock diseases is so formalized and deals with an enormous number of rules and regulations the issue simply stays on the agenda.

Secondly it stands out that the nature of the issue can hinder or help expansion, but due to the use of the visualization function of GIS, issues become simpler making expansion easier. In the case of HIS and FLIWAS it is impossible to give an unambiguous answer to whether water issues will expand easily. It must be said however that by using HIS and FLIWAS the issue itself became less complex and therefore easier to expand. In the case of the Riskmap the nature of the issue would help the issue expand in theory, in practice this does not happen. It must be said that while the issue is simpler now in the future this issue might expand very rapidly. In the case of contagious live stock diseases the nature of the issue neither helps nor hinders the issue to expand in theory. In practice we see that the issue does expand on the governmental level.

The third point which stands out in this channel is the policy window. In all the three cases the implementation of the GIS application itself made sure an opportunity arose in which ideas could be pushed forward. This was caused by new information becoming visible, integration of datasets, standardization, the calculation of complex data and the potential to visualize this all in a way a large number of people could understand.

Channel from the Policy Sub-System to Technology

Secondly a channel moves from the policy sub-system to technology. Here technology is made or shaped by the technological frames of the advocacy coalitions (Bijker, 1995, Orlikowski, 1992). When comparing the cases and taking into account what is said above on the characteristics of technology it can be seen that that closure on the meaning of technology does not always occur. What can explain this difference in terms of closure on the meaning of technology? First of all the existing closure on the meaning of technology in the Riskmap contrary to the lack of closure on the meaning of technology in HIS and FLIWAS and TSN can be explained by demands for action and the goal of the application itself. Where in HIS and FLIWAS and in TSN the calculations made demand for a certain action to be undertaken which have negative consequences for some actors, in the Riskmap this is not the case. Since no action has to be undertaken, few political values come into account. Simply demonstrating risks to citizens tends not to become so politicized as actions to be taken in water management or prevention of animal diseases. Since the Riskmap is less politicized closure on the meaning of technology occurs more easily. Additionally the applications itself are different, where HIS and FLIWAS and TSN are applications with a number of different features, calculation, simulation, communication and visualization the Riskmap only has one feature, the communication of risks. The simplicity of the application itself makes closure on the meaning of technology more likely.

Channel from Technology to the Policy Sub-System

Thirdly there is the channel from technology moving towards the policy sub-system, although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the policy sub-system (Orlikowski, 1992).

What stands out here is that whether closure on the meaning of technology has occurred or not, the meaning given to the GIS, either by all coalitions or for each separate coalition influences the actions in the policy sub-system. Mostly this is seen in terms of power. Those with access to the data and the application gain power and behave as such, while others regard this as a threat to their own power and behave accordingly.

When looking at the separate case studies it can be found that in the case of HIS and FLIWAS the applications are perceived by water management professionals as a device to expand their issue to the larger public. By other actors it is in that way perceived as a hindering device. Next to this, HIS and FLIWAS within the meaning given to them have the power in the policy sub-system to unite the different organizations in the water management sector, making them one advocacy coalition with combined power. Additionally we see that because the water management professionals control HIS and FLIWAS it serves as a provider of power to them in terms of possession of information.

In the case of the Riskmap everybody seems to agree on what the Riskmap is and should be. This channel does not prove to be of major influence in the case of the Riskmap. It is clear that all parties agree that after the Riskmap is shaped nothing changes in the policy sub-system since there was consensus to begin with. The only point that can be made is that while the municipalities and provinces regard the Riskmap as a means for citizens to execute power, citizens do not see this potential yet or are just uninterested.

In the case of contagious live stock diseases we see that while closure on the meaning of technology has not occurred, the technology of TSN is not shaped as an artifact at this point. The experts with access to TSN have shaped TSN and since they are the prime source exerting power, they have a large deal of power in the policy sub-system leaving those organized out of TSN powerless.

Channel from Technology to Structure

Finally there is the channel moving from technology towards structure (Giddens, 1984). After the actors in the policy sub-system have shaped technology and closure on the meaning of technology occurs, the established technology will influence the structure, new rules and laws might be made and it will be embedded in the culture. So the structure is a result of previous actions (Orlikowski, 1992).

Here it can be seen that GIS, by their functions and effects of calculation, integration, visualization, communication and transparency, and by the actions in the policy sub-system, eventually can influence the structure. New laws are made on the basis of

Table 13.5: The Framework of Agenda-Setting

	HIS/FLWAS	The Riskmap	TSN
Structure to Policy Sub-System	Structure limits the actions in the policy sub-system due to formal institutions not being laid down. The nature of water issues hinders the actions in the policy sub-system. GIS accounted for the opening of a policy window.	Structure enables the actions in the policy sub-system due to the formal institutions which make actions possible. The nature of the issue limits the actions in the policy sub-system. GIS accounted for the opening of a policy window.	Structure enables the actions in the policy sub-system due to the formal institutions which make actions possible. The nature of the issue limits the actions in the policy sub-system. GIS accounted for the opening of a policy window.
Policy Sub-System to Technology	Closure has not occurred due to the high politicization of the issue and the complexity of the application	Closure has occurred due to the simple goal of the application.	Closure has not occurred due to the high politicization of the issue and the complexity of the application
Technology to Policy Sub-System	The shaping of technology makes sure those with access to the data and the application gain significant power over others.	The shaping of technology makes sure citizens have access to the information which gives them a power potential, however this potential is not used.	The shaping of technology makes sure those with access to the data and the application gain significant power over others.
Technology to Structure	Structure is influenced since new laws are being made because of the outcomes and possibilities of the GIS and the water sector is integrating itself, functioning as a power block.	Structure is influenced since new regulations are being made because of the outcomes and possibilities of the GIS.	Structure is being influenced since new laws are being made because of the outcomes and possibilities of the GIS.

the outcomes and possibilities of the GIS, and power relations are altered because of the shaping of the technology by which some gain power and some do not.

Looking at the case studies this can be backed. In the case of HIS and FLIWAS, HIS does influence the structure to a large degree, by uniting the water management sector they can be more perceived as a block by the formal institutions. Next to this the calculation and the possibility to communicate this properly to policy-makers made sure water management professionals are taken more seriously and are more often invited to negotiations.

For the case of the Riskmap we see that the Riskmap will be used for prevention as well, it will be explained on the map what to do in cases of emergency, this will probably be laid down by law. Furthermore it is expected, and also feared by the municipalities, we will see a culture in which citizens will actively be involved in the risks in their area. It is also expected that the trend of first aid agencies obtaining more and better access to negotiations especially in urban planning will be set through.

In the case of contagious live stock diseases we see that even though closure on the meaning of technology has not occurred, those experts with access to TSN have the power to such a degree that they are able to influence structure through the technology. New rules are being made on prevention, containment and disinfection on the basis of the outcomes of calculations made in TSN.

13.3.3 Conclusions

After looking at the different variables separately of the conceptual framework of agenda-setting and the three parts and the four channels of interplay we can draw some conclusions on what this means when dealing with agenda-setting while using GIS.

When looking at the building blocks first we can see that on several levels the use of GIS can influence these variables.

When looking at the course of the process of agenda-setting we see that first mobilization of bias is very present, and the usage of GIS can even make this mobilization of bias stronger. Because all information is often in one application, those with access can mobilize their interest over the interests of those without access. For the course of the process of agenda-setting this means that some actors are placed outside the arena. This strong mobilization of bias because of the GIS application does not always occur, as was the case for the Riskmap. There are no conflicting interests to be mobilized. What counts for mobilization of bias also goes for power, because of access to the application and the data some gain power over others, those with access now have a clear advantage over those without access, this can, and often will, account for a shift in power. This shift in power sometimes is so severe that now technicians and experts are allowed and able to make decisions formerly done by politicians. This means a shift in the course of the process of agenda-setting. Power relations prior to the use of GIS are now different and this changes the course of the process. For the course of the process of agenda-setting this means that these new issues need to be dealt with. The formal institutional features also play a large part in the course of the process of agenda-setting. Here we see very clearly that when the application is initiated by the government and the application itself is embedded in legislation the agenda-setting power derived from the application is large. The application is seen as a tool to use in the course of agenda-setting. When the application is not initiated by government and not embedded in formal institutional features the agenda-setting power to be derived from the application is a lot less, because the actors initiating the application are not granted any formal power. The nature of the issue does not seem to interfere with the course of the process of agenda-setting. Maybe because the issue becomes less complex due to the use of GIS it could expand more easily but this hardly happens. This can be explained by the theoretical notion that the nature of the issue as theory is not made to be used for these sort of issues. It deals more with expanding to a larger public through mass media and less with agenda-setting by institutions. Finally the policy window does have an effect on the course of the process of agenda-setting since the implementation and existence of the GIS cause a policy window to open.

When looking at the content of the process of agenda-setting we can conclude the use of GIS as well has a large impact. Firstly this is seen by the variables of mobilization, power and conflict. These three variables, as explained above, account for a possibility for those with access to the application as well as to the data to push their issues forward because they have more information than others. Additionally they now have the possibility to calculate, simulate and decide what information to share and with whom. They can therefore, through the use of GIS, influence the content of the process of agenda-setting significantly. The formal institutions are important as well, when the government has initiated the application and the application is embedded into the formal institutions the actors mentioned are granted even more power. Because this is organized institutionally, their ideas are more likely to be found back in the content than the ideas of others. When this is not the case, when the government has not initiated the application and the application is not institutionally embedded, we see the reverse. Finally for the policy window, the impact on the content of the process of agenda-setting is large, new issues can be pushed forward.

For the outcome of the process of agenda-setting the same can be said as for the content, through mobilization of bias, power and conflict those with access to the data and the application have a clear advantage over others to see their issue reaching agenda status. This can be intensified when the application is initiated by the government and is institutionally embedded. For those without access the opposite is the case, they are very unlikely to see their issue reaching agenda status simply because they cannot use the GIS.

Secondly the three parts and the four channels of interplay show us a number of issues. Firstly we see the structure influences the actions within the policy sub-system. Here it is very important who initiated the design of the GIS. The initiator benefits from the GIS since it serves the initiators interests, or else he would not have initiated it. Also it gives the initiator access, granting him power. The nature of the issue does not seem to have a lot of influence here as well since it is theoretically not suited to deal with these kinds of issues. The policy window does demonstrate an influence while it has been opened by the existence of the application.

Secondly it is important to look at closure on the meaning of technology, sometimes it occurs and sometimes it does not. This can be explained by a number of factors. Firstly it can be explained by the goal of the application itself. This is directly linked to whom initiated the application, an application which demands action will achieve closure on the meaning of technology far less quickly than an application that does not and only serves the purpose of communication. Secondly the scope of the application is important, an application with a lot of different functionalities will reach closure on the meaning of technology far less quickly than an application with little functionalities. This is so because the application is easier to grasp. Thirdly the subject itself is important; a highly politicized subject will less likely reach closure on the meaning of technology than a subject which deals with little political values.

Thirdly and linked to the second point is that it is very important for the process of agenda-setting how the GIS, whether closure on the meaning of technology has occurred or not, is perceived by the actors in the policy sub-system. This is mostly to be seen in terms of power. Those who regard the GIS as a tool by which they gain power will behave as such and will push their issue forward fiercely. Those who consider the GIS as a tool limiting their power and view it as a threat to them will behave the other way around. They will be more careful in pushing their issue forward, since they know they do not possess the power to do this in a fierce matter. This influences the course as well as the content and the outcome of the process of agenda-setting as described above.

A final conclusion can be drawn on the point whether GIS, once shaped, can influence structure. We clearly see this happening, firstly at the point when the application is designed, when the government makes legislation before implementing the application. Secondly this can be found when the application is implemented already, when the shifts in power become structurally embedded or when the application calls for new laws. This influencing of the structure will have an effect on agenda-setting. Once power relations are institutionally embedded and laws are made, the policy sub-system will react to this and the new power relations and the new laws will influence the process of agenda-setting, again mostly in terms of power.

13.4 DESIGNING POLICY

After looking at the qualities and effects GIS can have and have had in the case studies, and looking at the agenda-setting cases now the policy design cases can be dealt with. First, in this section policy design will be looked at. Here it will be looked at what the influence of the perception of GIS is on the course, the content and the outcome of the process of policy design. The three cases dealing with policy design, Virtuocity, particulate matter and Congestion Charging will be compared with one another in order to come closer to answering the main question.

13.4.1 Concepts of Policy Design

As in the case studies first the building blocks of the conceptual framework will be dealt with before moving forward to the actual conceptual framework of policy design. First bounded rationality will be dealt with, next satisficing, thirdly conflict of values, fourthly power, fifthly the formal institutional features, sixth the rules in use and finally culture. An overview of each case is given in table 13.6.

Bounded Rationality

The bounds in rationality hold the idea that humans are limited in their capacity to be fully rational. In policy design issues this means that not all alternatives for a policy problem can be looked at and that not all consequences can be predicted (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968).

What is seen in all cases that the use of GIS both decreases and increases the bounds of rationality. A decrease is to be seen by the increased transparency for all actors by the communication, calculation and visualization functions and effects of GIS. An increase can be found in first the fact that the application is new and consequences cannot be predicted, which does not only count for GIS but for any new application. Secondly bounds of rationality increase because calculations hold large margins of error, making sure policy might not be based on an accurate number. This is also not solely apparent in GIS but can be found in any calculating technology. Finally the bounds of rationality increase because communication does not precede in a way all actors understand, which can also be seen in other applications.

Backing this by looking at the case studies we see the decrease in the bounds of rationality first of all in the case of Virtuocity. For citizens and for the local governments the bounds of rationality decreased. While citizens and also governments formerly were not able to understand plans for redevelopment, it becomes clear that with the visualization function of Virtuocity that the plans became understandable. For governments it also became clearer what the opinions of citizens were.

Table 13.6: Variables of Policy Design

	Virtuocity	Particulate Matter	Congestion Charge
Bounded Rationality	Bounds decrease because plans for redevelopment became more transparent as well as citizen's opinions. Bounds increase because consequences of the application are unknown.	Bounds decrease because measurements of particulate matter became evident and consequences of building plans became more transparent. Bounds increase because the outcomes of calculations hold large margins of error.	Bounds decrease because effects of measures for reducing congestion became more transparent. Bounds increase because the effect of the application could not be predicted and margins of error are large.
Satisficing	Satisficing occurs because policy-makers are unaware of the potential of the application.	Satisficing occurs because GIS calculates in nominal numbers and is not able to calculate a nuance in these.	Satisficing occurs because of the engineers working with the application do not have the skills to deal with matters civil engineers deal with.
Conflict of Value	Conflict occurs mostly in the area of participation and communication strategies.	Conflict in terms of communication strategies and legitimacy of outcomes.	Conflict in terms of social values and communication strategies.
Power	Power shifts towards citizens but this is limited, also a power shift towards computer experts. Most power stays with the government.	Power shifts towards scientific community and experts. Most power stays with the government since they can still have a say in building plans.	Power shifts towards experts, all power moves to Transport for London, which is linked to the government.
Formal Institutional Features	Formal institutions hindered the potential of Virtuocity since not all potential is used due to legal boundaries.	Formal institutions help policy on measuring and dealing particulate matter since all is laid down by law. Because the law allows for governments to choose their own application, formal institutions also hinder an integrated policy.	Formal institutions help policy on the Congestion Charge, since all was organized into one organization and since all was laid down by law there was not a lot possible in terms of policy design.
Rules in Use	Rules in use account for a need for citizens to participate and demand for interactive policy-making.	Rules in use relate to a idea of trusting nominal numbers even though the margins of error are large. The rules in use also account for not involving the public.	Rules in use account for a system in which all power and all room for decision was centered in one organization making sure others where powerless.
Culture	Culture of risk aversion makes sure Virtuocity is not used to its full potential	Culture of trusting nominal numbers accounts for a culture of distrust making sure a lot of conflict occurs. The lack of a culture dealing with particulate matter makes policy design difficult.	Culture of politicization and protest hinders policy design. All issues are subject to public protest and become politicized.

In the case of particulate matter it is demonstrated the national government has obtained an application measuring and calculating particulate matter so that concentrations of particulate matter are clearer than before. Simply because they were not measured at such detail all together. In the development of building plans now it becomes clear, by the use of GIS what the effects on air quality actually are.

In the case of Congestion Charging we see a clear decrease of the bounds of rationality. This is evident when we look at the way GIS are used to calculate all the data gathered by monitoring road use, key traffic points and simulations on where the zone should be. In this way it became very clear in which situation which costs and benefits would be reached in reducing congestion. Furthermore we see a decrease in the bounds of rationality through the visualization of the application. Where before the data was very difficult to understand for policy-makers, now while placing them in a map it becomes easier to actually understand the consequences of implementing the zone in terms of effects and its impact on congestion.

On the other hand the bounds in rationality have only increased while using GIS. In the case studies this can be found. In the case of Virtuocity in the policy design process for the urban redevelopment the local government had no idea how citizens would respond and how the process of designing policy for the urban centers would proceed. A proper cost benefit analysis was simply impossible.

In the case of particulate matter we see an even larger increase in the bounds of rationality. Firstly this can be found on the part of science. It is not completely clear how to measure concentrations of particulate matter and what the equation should be, so bounds of rationality are very large. On top of that the effects of potential building plans in terms of particulate matter are an estimate as well. Therefore it is very difficult to understand consequences of any policy design in this field. The norm itself might not be correct because we cannot predict the danger of any concentration to public health. For these reasons it is not possible to calculate all costs and benefits of every possible policy alternative.

In the case of Congestion Charging the bounds of rationality have increased. While simulations worked very well, the system of CCTV proved to be not 100 percent accurate but 90 percent at best. This made it difficult to understand consequences and calculate results of the application. Furthermore since the application was completely new consequences could not be predicted. Questions on what the impact for businesses in the zone and right outside the zone were could not be answered. On the side of the citizens of London bounds of rationality only increased, since communication between Traffic for London and Londoners was poor. Londoners are still very confused on where the zone actually starts.

Satisficing

The concept of satisficing instead of optimizing (March, 1994) stems from these bounds of rationality. When one is not able to list all alternatives to a problem, chances are that a perfect solution will not be found, therefore a policy-maker will often settle for a solution which is just 'good enough'.

On this point we see that in three cases a solution is chosen which is not optimal. Satisficing occurs because time and money are pressing or because consequences cannot be predicted. Especially in terms of imperfect calculations and margins of insecurity and the cost of the application a satisficing solution is found. This is not always to be attributed to the use of GIS but in some instances it is. Namely when actors are not sure what the application can or cannot do they are reluctant to use the application to its full potential. A second point is that GIS, when calculating, deals with nominal numbers, margins of error do exist but the application is not able to calculate it in another way.

When looking at the case studies individually, it can be found that this is apparent. In the case of Virtuocity we see that a satisficing solution was implemented in both cases. Virtuocity was chosen since no other application was available for the same price and within the same time frame. For Tilburg time was also pressing so searching for alternatives even longer would prolong the process and the deadline would not be reached. In Helmond the government actually wanted a voting moment but because consequences were too hard to predict in the end this was not done.

In the case of particulate matter we see this back in the norm itself. The concentrations of particulate matter, which the Netherlands cannot exceed, are far from optimal; since it is now not possible to lower the norm without extensive economical damage, the European Union has settled for a less than optimal solution. Secondly we see satisficing back in the policy on how to decide which building projects may continue and which may not as well as in plans to compensate excess in concentrations. Where by law the outcome of the calculations is a hard, nominal number, in reality this number has a large margin of insecurity. But this is not taken into the decision-making process.

In the case of Congestion Charging it is demonstrated that congestion has not actually diminished, road use has diminished but the extra space has been filled with road works and extra busses. A decrease in traffic jams is not to be seen. Another point in which we see that especially the London council has settled for a satisficing solution is in the matter of the neighborhood issues. While it was calculated that the zone should be at a certain point the social data of neighborhoods was not taken into the equation. A third point where satisficing is clear is where the residents of London are concerned. Consequences of the zone were in the beginning not to be predicted, after the zone was installed the London Council had to settle for some of the negative consequences. Examples are as residents not being able to visit first class facilities, paying large sums to the Congestion Charge when going to work and businesses losing money. Another important point of satisficing is the financial costs of the Congestion Charge. The original goal of the application was to make sure that the money gained with the Congestion Charge would be reinvested in transport. This was not completely possible and the London Council together with Transport for London was forced to satisfice for this solution.

Conflict of Values

The third core concept in the conceptual framework of policy design is conflicts of values (Etzioni, 1967). It can be seen in each case that the use of GIS can cause conflict, this in terms of participation and exclusion, legitimacy of calculations and norms, proper communication and social values.

When looking at the case studies individually these conflicts all come forward. Firstly in the case of Virtuocity we see in Helmond there were few conflicts. Citizens as well as the local government and CEBRA seemed to agree on all steps taken. The only conflict to be found is the conflict within the government of Helmond on participation, the issue of voting for the mall. There was one faction that opposed and one that wished to do so. In Tilburg the situation was different. A conflict occurred on the matter of participation, while only dealing with computers and no ballots some people could be excluded. In the process of policy design regarding the redevelopment of the square the conflict between citizens and government seems to be the largest. Here while a group of citizens feels taken seriously another group holds the opinion Virtuocity is only used to enforce an idea upon them and democratization is definitely not what is going on.

In the case of particulate matter there are several conflicting values as well. First of all we see the conflict between technicians and policy-makers. The technicians have developed the applications used to measure and calculate concentrations of particulate matter. But they seem to be unable to communicate this to policy-makers in an understandable way. The reason for this brings us to the second instance of conflict, namely the conflict between the scientists and policy-makers. Here we see particulate matter is such a complex matter scientists cannot communicate it to policy-makers, nor to the public. Hence the reason why technicians cannot explain the application, the variables are too vague and the calculations too difficult. Where the real conflict occurs here is that policy-makers, in order to make accurate policy on building project, want a hard, nominal number to base their decision on. The scientists are not able to provide for such a number. A conflict can also be found between the environmental organizations and local politics and building corporations. Here we see the environmental organizations do not agree with the way the local governments and often building corporations deal with the application itself. Finally there is a conflict between politics (local and national) and citizens. Citizens seem not to be very interested in particulate matter issues, but the citizens who are, are not able to gain information they can understand.

In the case of Congestion Charging the most pressing conflict is the conflict on whether the charge should be implemented or not. The Labour party and Transport for London were very much in favor of the charge, the Conservative party and a large group of Londoners were not. The Conservatives claim the charge violates the freedom to travel and it reduces the residents just outside the zone to second class citizens. Residents claim the charge to be an unfair tax. A second conflict is to be found in the fact the goals of the application are not met; the money gained with the charge is not reinvested into public transportation and better roads but is used for maintenance of the charge itself. Londoners as well as the Conservative party are very angry about this. Even though they did not approve of the charge to begin with, they feel lied to and are upset that promises are not kept. Another conflict occurred when the debate started on whether the residents just outside the zone should have the right to a discount. The Labour party was opposed since it felt the whole point of the charge was to make sure people would not take their car into the zone. The Conservative party was very much in favor of this discount since they felt that the lives of these people were severely affected and their freedom to travel was violated. Another conflict is family values. The Conservative party claims the charge to be anti-family, first of all because it hits families hardest, they are mostly car owners. Furthermore, the areas where most families live are just outside the zone but all first class facilities like healthcare, schools and maternity wards are inside the zone. The charge therefore, according to the Conservatives, makes sure families are the ones to pay. On top of this the matter of dividing neighborhoods was added to this, making sure that a visit to grandma, or taking your family to church became expensive.

Power

Power issues, linked to the conflict of values are the fourth building block of the conceptual framework of policy design (Etzioni, 1967; Dahl, 1961). Actors use their power to push their solutions and ideas forward towards a policy design. Comparing the cases with one another it becomes clear that the use of GIS, through their functions and effects of calculation, integration, visualization and communication, account for a shift in terms of power. Those with access to the data and the application clearly gain in relative power. They are the ones deciding which calculations to make and what information to show and share. In all cases it is to be seen that power mostly stays with those already in power, in line with the reinforcement thesis (Kramer & King, 1986). It is also seen that in all cases power shifts towards experts where this power was formerly with politics.

Backing this by looking at the cases individually it can be seen that in the case of Virtuocity most power stays with the government. In Helmond this is very clear since the city of Helmond formally takes the final decisions. In Tilburg citizens do not believe the government would take them seriously and in the end they felt that even though they could vote, the government decided what they could vote for. Although it must be said that while Virtuocity may strengthen the government there is some power that floats towards citizens while they have an easy access way to voice their opinion. Citizens in both cases gained power compared to conventional ways of urban redevelopment. CEBRA also holds a large deal of power. It was able to influence the government by pushing it forward to extend the web application and persuade the city of Tilburg to include a forum and a chat in the design.

In the case of particulate matter we see that the national government and the European Union still hold a large deal of power. They are the ones deciding on the norm and how to deal with this norm. What we also see is that the scientific community has a large deal of power in this matter. There it is decided how to appropriately calculate the concentrations of particulate matter and what the outcomes mean. Furthermore technicians developing the applications by which the measurements and calculations are made hold a large amount of power. Nobody in policy-making and politics actually understands how the application works and simply assumes technicians have done the best they could. When looking at the local governments we can see two things, firstly they have lost power in the way that before there did not exist any regulations on particulate matter they had more say in what was to be built on their territory. Now with these regulations they are bound to them. On the other hand we see that they have the power to decide which application they would like to use in order to measure concentrations of particulate matter. For environmental organizations the same goes. They feel like they are given more power by the fact that there are regulations on particulate matter concentrations. But they are also able to manipulate the data so their preferred outcome will be achieved. Citizens in this have no real power, they have the possibility to go online and check the concentrations on particulate matter on the national level and in their own region (provided that their own municipality makes these data available) But the information online is often not clear to citizens.

In the case of Congestion Charging we see a number of things. First of all at the time of the implementation of the charge the Labour party was in power and the Mayor, Ken Livingstone, held a large deal of power. They decided on the charge and even though the Conservative party was opposed the charge was implemented. The Labour party delegated virtually all power and room for decision to Traffic for London to implement the charge. Transport for London had the power to decide where the zone should be actually located, what technology should be used, how the technology should be used and so further. Transport for London had almost complete power over all the details and had very little obligation to communicate this to the public. This left all opponents of the charge powerless. The only time citizens actually had power to decide was on the consultation on the western extension. At first citizens did not believe they would be listened to, they claimed Transport for London would do what they wanted regardless of the outcome of the consultation. Another point in terms of power has to be made here. The entire calculations on where the zone would be were largely made by GIS experts. A lot of resident groups where very angry about this because they believed these decisions should have been made by civil engineers, they claim that because of this, neighborhoods are divided since computer experts have no experience in the field of transportation and have little knowledge of effects of measures in transportation.

Formal Institutional Features

Moving towards the fifth core concept and looking at the structure side there are the formal institutional features (Ostrom et al., 1994). These are the official laws and regulations. Like in the comparison for agenda-setting the formal institutional features can both help and hinder policy design while using GIS. In cases in which the application was laid down by law the application helped policy design, since here it was clear what is allowed and what is not. Since in all cases the reinforcement thesis can be applied it follows that when those already in power initiate the application the formal institutions will help that application (Kraemer & King, 1986).

This becomes clear in all three cases. In the case of Virtuocity in Tilburg the voting did not have the character of a formal referendum since this would legally be very difficult. If the vote had the character of a formal referendum groups would be excluded, which would make the process not democratically legitimate. Also the means to detect fraud were not available, therefore a formal referendum was out of order. Additionally it is seen in Helmond attempts made to achieve a situation in which voting was possible, failed because of opposition. Governments are often unable to understand how an application works and what its potential is and citizens do often not have the needed skills or equipment. It becomes clear here that in the policy design process the existing legal boundaries can prove to have a large impact on the policy.

In the case of particulate matter we see that formal institutions are very important. Local governments have the opportunity to look at possibilities to build on their territory. However the formal institutional features, prohibit them to do so when the potential concentration of particulate matter will exceed the norm. The norm is very clearly institutionalized but the way to achieve the concentration of particulate matter is not, since data can be manipulated. Furthermore we see it is formally established that a judge judges whether a building project may continue or not. This decision is based on the outcome of calculations and how these corresponds with the norm.

In the case of Congestion Charging it becomes clear the formal institutions had a very large impact and mostly helped the implementation of the zone. Firstly because of the structure between the party in power and the party being in the opposition in Britain it was very easy for the Labour party to make legislation on the Congestion Charge. Another formal institutional feature which was very helpful in implementing and designing the zone was the fact that London has one organization for all transport issues. An organization in which not only public transportation was organized but also road use, road maintenance and walker and cycler interests. This made one London wide plan for transport possible, integrating the charge into this plan.

Rules in Use

Next to the formal institutions the informal rules and codes of conduct are important; they can affect the process of policy design significantly (Ostrom et al., 1994; Stone, 1997). In the comparison of the cases it can be found that the rules in use have a large impact on how actors deal with GIS, how they use it, perceive it and communicate it to others. This comes forward in terms of interaction with citizens and other actors and the reliance on numbers.

In the individual cases this can be found as follows. In the case of Virtuocity it is seen in both Tilburg and Helmond that the rules in use in this matter require citizens to participate in the redevelopment of their city. Another point that falls under the rules in use in this situation was interactive policy-making.

In the case of particulate matter we see the rules in use present a situation in which each outcome of each calculation is debatable. This holds that any decision made on a building project is always illegitimate in someone's eyes. This makes that most parties distrust one another. What we also see in the particulate matter case is that while all involved actors agree on the idea that these decisions on spatial planning policy cannot be made by the numbers produced by the calculations made. The rules in use are thus to use these nominal numbers, as laid down by law, but also to constantly debate the decisions and the policy design resulting from them.

In the case of Congestion Charging it can be found that even though the rules in use have a large impact in this case we only see them on one occasion. This is on the occasion where Transport for London was delegated all the power to implement and design the zone. They had no past of inviting a lot of other actors to the negotiation table and were able to decide on all details by themselves without having to deal with opposition of other actors. A clear past of negotiation with a number of parties was not present and the normal way of interaction was thus not to invite others to the table. This made sure implementation and design of the zone moved quickly and smoothly.

Culture

The final building block for the conceptual framework of policy design is culture (Ostrom et al., 1994). In the cases it was shown culture has a large impact on how GIS are perceived, used and communicated. Here we see that risk aversion, due to the bounds in rationality is present, a culture of distrust but also a culture of trusting numbers, politicization and the familiarity with an issue matter significantly.

In the case studies we can retrieve this. In the case of Virtuocity leading values and norms show us two things, firstly that citizens do want to participate in the redevelopment of their city. A number of citizens feel taken seriously. Secondly we see a culture in the government of risk aversion; this is the reason why governments are reluctant to push e-government applications to their full potential.

In the case of particulate matter first of all a culture of distrust is to be found, all the calculations and outcomes are perceived as debatable. Several actors accuse each other of manipulating the data so the data fits their cause. Secondly it can be found that in a number of local governments the particulate matter laws and the measures they have to take to reduce concentrations of particulate matter are perceived as a burden. This results in a culture among local governments in which the particulate matter concentrations are not perceived as a health related issue at all, but as a huge burden from which they need to find a way out of. What is also clear is that we are dealing with a culture in which it is often believed when we measure something we can be sure on this measure. A culture which is used to dealing with hard numbers is present. Thirdly and very importantly, in the Netherlands there is no established culture dealing with particulate matter or air quality to begin with. Reasons for this could be that the particulate matter issue is fairly new but it could also be caused by the level of abstraction of the issue.

In the case of Congestion Charging first of all it must be mentioned that there is a culture in which issues are always very politicized. We see in the culture in London as well as in other parts of Britain that often an issue is directly made a political one where mostly Labour and the Conservatives both take the other side. The second point hindering the implementation and designing of the charge was a culture of protest. In London residents are used to protest against a decision they do not approve of, an interest group is quickly formed.

13.4.2 The Influence of GIS on Policy Design

Like we have done for agenda-setting, after looking at the variables making up the conceptual framework of policy design, the conceptual framework of policy design can be looked at in relation to the cases.

As mentioned in the case studies the conceptual framework of policy design consists out of three parts and four channels of interplay. First the three parts will be discussed since these three parts are very case specific they cannot be compared. Therefore they will only be discussed for the means of overview. The four channels of interplay can be compared and will be after the three parts are discussed. An overview of the comparison will be given in table 13.7.

The Action Arena

The action arena is the space in which all involved parties interact. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The tech-

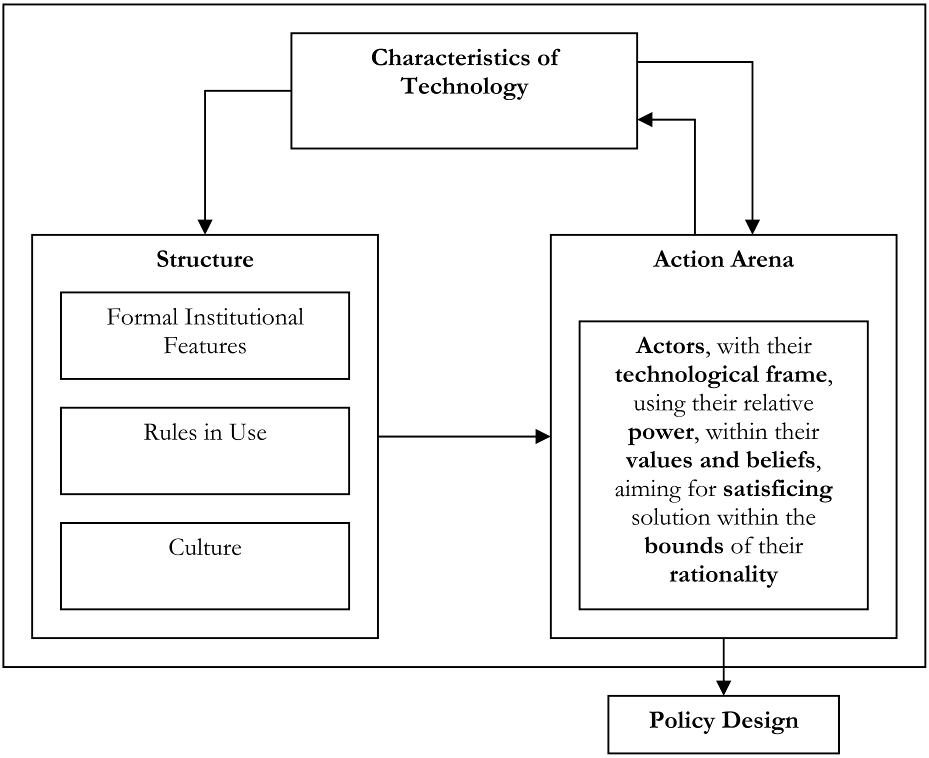

Figure 13.2: The Conceptual Framework of Policy Design

nological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They then use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

When looking at the case studies we see that in Virtuocity the actors in the action arena are the local government, since they decide on the final implementation, citizens of both cities, since they interact in this process and CEBRA as the designer of Virtuocity. In the city of Tilburg also the architects are included as actors since they designed the different alternatives for the urban center. Citizens have gained in power, and the local governments have lost some of their power towards citizens, in Tilburg more than in Helmond, and to CEBRA. In Tilburg there is less agreement and some, mainly the local government, believe Virtuocity to be an application to make plans visible but citizens believe Virtuocity is a mean to communicate. This communication between government and citizens has not occurred. Other citizens believe Virtuocity is a tool to exclude some citizens and is used by the government to manipulate citizens into believing they have a say.

Table 13.7: Conceptual Framework of Policy Design

	Virtuocity	Particulate Matter	Congestion Charge
Structure to Policy Sub-System	Structure helps policy design since the laws are laid down, because of the rules in use citizens do participate but the potential of the application is not used. A culture of risk aversion limits policy design.	Structure helps policy design since everything is formally laid down by law. The rules in use, calculating in nominal numbers and accusing one another, and a culture of distrust make policy design more difficult.	Structure helps policy design since all power is formally laid down with one organization. The rules in use enforce this. Policy design is limited by a culture of quick politicization.
Policy Sub-System to Technology	Closure occurred in Helmond due to keeping Virtuocity simple. In Tilburg because of politicization closure has not occurred.	Closure has occurred because all actors consider the technology untrustworthy and manipulable. This is due to more than one actor having access to the data and the application.	Closure has occurred because all actors consider the technology neutral. They just do not all agree with the policy made.
Technology to Policy Sub-System	The shaping of technology makes sure in Helmond not a lot changes, due to the simplicity of the application. In Tilburg the shaping makes sure those with access to the application gain power over others.	The shaping of technology makes sure all actors use the application as a source of power; several actors have access to the application power relations are very much blurred.	The shaping of technology accounts for the rise in power of those with access to the application and they behave as such.
Technology to Structure	Technology influences structure in the way that in Helmond the practice of using Virtuocity has become rule in use. In Tilburg this has not happened	Technology influences structure by accounting for new power relations which are reflected by the rules in use and an emerging culture of distrust	Technology has influenced structure since new legislation is made. Rules in use and culture have not changed dramatically

In the case of particulate matter the battle between policy ideas mostly moves between the RIVM and the ministry of VROM, where the RIVM is generally in favor of reducing concentrations of particulate matter the ministry of VROM has to balance this against economic interests. A second conflict is the one between municipalities and building corporations on one side and environmental organizations on the other. Where municipalities and building corporations would still like to build, environmental organizations want to prohibit this for reasons of air quality. Both opponents ground their argument in the inaccuracies of the applications.

Finally in the case of Congestion Charging the battle is between the two coalitions, the one in favor of the charge and the one opposed. After the coalition opposed to the charge lost the battle on the charge came into place, different conflicts occurred on how the charge should be conducted, what exemptions to make, how to extend and so further. In each conflict the lines of conflict move around the same two coalitions which do not change of composition.

Technology

The second part of the conceptual framework for policy design deals with the characteristics of the technology itself. Here it is important which meaning GIS have been given and whether closure on the meaning of technology and stabilization have occurred (Bijker, 1995).

In the case of Virtuocity it can be found that closure on the meaning of technology has occurred in Helmond but not in Tilburg. In Helmond closure on the meaning of technology existed fairly quickly, both government and citizens agreed that Virtuocity was a tool for communication, visualization and transparency. They also agreed this tool would give citizens the possibility to be a partner in the designing of a new urban center. In practice this actually happened, citizens were taken seriously and felt that way. In Tilburg however this was not the case, closure on the meaning of technology did not exist. There was debate on what Virtuocity was, the government considered it a tool for transparency, giving citizens information on what they could vote for. But citizens and CEBRA also regarded Virtuocity as a tool for communication. When the government did not communicate back on the forum citizens felt disappointed and not taken seriously. Secondly the local government considers Virtuocity to be an application to empower citizens and to close the gap between governments and citizens. Some citizens believed they were lied to and Virtuocity did not give them any power at all since they could not really voice their opinion.

In the case of particulate matter it can be found that the applications to measure, calculate and present concentrations of particulate matter are mostly seen as a calculation device. Only the RIVM considers it to be a communication device additional to the calculation device. Furthermore all involved actors and coalitions agree that the application is mainly a source of power. Each coalition accuses other coalitions of using the application in such a way that data can be manipulated and outcomes are manipulated only to serve one's purpose. All together in the particulate matter case closure on the meaning of technology has occurred since all view the application the same way, namely an untrustworthy and manipulable tool for calculation.

Finally the GIS running the background of the Congestion Charging scheme are primarily seen as a tool for calculation, simulation and visualization of where the zone should be, what the effects are and how to proceed with congestion charging. All involved coalitions agree on this but they value it differently, where the coalition in favor of the charge sees this technology as a very helpful device, the coalition opposed sees the technology as a tool for implementing something they do not want to have. Both coalitions consider the technology trustworthy. Therefore closure on the meaning of technology has occurred.

Structure

The final part of the conceptual framework is structure; this includes the formal institutional features, the rules in use and culture (Ostrom et al., 1994). These can help or hinder the actors in the action arena, they influence the scope of actions possible. For the formal institutions it can be said that in the case of Virtuocity they influence the action arena in the way that not everything is possible in terms of building. The scope of the building alternatives are limited by law, therefore all actors were bound to the law and could not just build or ask for any alternative. In the case of particulate matter the formal institutions bind local governments and building corporations to the existing norm, they do this as well for the environmental organizations. These formal institutions do not exactly hinder anyone in the arena but do limit the scope of action possible and limit the policy alternatives which could result in a policy design. In the case of Congestion Charging the formal institutions made it possible for the Labour party to give Transport for London control of almost all decisions. Because of the formal institutions none of the actors in the coalition opposed to the charge had the power to effectively exert influence and stop the Congestion Charge. This made the implementation and design of the charge very easy.

Secondly the rules in use were important, in the case of Virtuocity they accounted for a situation in which interactive policy-making became the norm. This was more the case in Helmond, where citizens actually became partners than in Tilburg where they could vote. This did give citizens a lot of new power, even though in Tilburg not all citizens felt it that way. In the case of particulate matter the rules in use limit interaction very clearly in the action arena. First of all the rule in use of thinking in hard numbers limits all actors in the action arena to realistically deal with concentrations of particulate matter. The rules of conduct regarding accusations made and distrust hinder cooperation between coalitions as well as communication. Finally in the case of Congestion Charging we see the same as for the formal institutions. Because Transport for London did not have to invite a number of other actors to the negotiation table, opponents of the charge could not exert influence and implementation proceeded smoothly.

Finally culture influences the action arena. In the case of Virtuocity this comes back in terms of wanting to participate on the side of citizens and wanting citizens to participate on the side of government. This also made sure in the action arena citizens gained power and participated in fairly large numbers, especially in Helmond. In the case of particulate matter a culture of distrust hinders communication. The fact that there is no culture present dealing with particulate matter makes some decisions hard to accept for some actors. Finally in the case of Congestion Charging culture helped the coalition in favor of the charge, Londoners were tired of the large traffic jams and naming the charge 'charge' instead of 'tax' benefit the coalition in favor of the charge. On the other hand, a culture of very quickly politicizing issues and a culture of quick a frequent protest on the side of citizens made sure the coalition opposed to the charge could have its voice heard.

Channel from Structure to the Action Arena

After dealing with the three parts of the conceptual framework now the four channels of interplay can be dealt with. Firstly there is the channel moving from structure to the action arena. Here the action arena is influenced by the three parts of structure, the formal institutional features, the rules in use and culture. The structure can both help and hinder policy design and is partly dependent on the use of GIS.

When looking at the case studies two things must be pointed out. Firstly it must be noted the actions in the action arena can be hindered or helped by the formal institutions. In cases in which the application was laid down by law the application helped policy design since here it was clear what is allowed and what is not. When those already in power initiate the application the formal institutions will help that application. This is correspondent with the reinforcement thesis (Kraemer & King, 1986). In the case of Virtuocity this can be found in the fact that the local governments decided on which topics citizens could participate. In the case of particulate matter it stands out that the norm was laid down. For Congestion Charging it can be said that because of the formal institutions, as well as the rules in use, all power moved to one organization deciding on the charge.

Secondly it stands out that a culture of risk aversion due to the bounds in rationality is present. A culture of distrust but also a culture of trusting numbers, politicization and the familiarity with an issue matter significantly. In the case of Virtuocity risk aversion is clearly present, since consequences could not be predicted the local governments did not use the full potential of Virtuocity. In the case of particulate matter there existed a culture of distrust resulting in a situation of constant conflict between building cooperations and environmental organizations. Also a culture in believing in nominal numbers made policy design very difficult. In the case of Congestion Charging a high level of politicization occurred which caused for conflict.

Channel from the Action Arena to Technology

Secondly there is the channel influencing the action arena through technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artifact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992).

Here it stands out, as explained in the section on characteristics of technology that closure on the meaning of technology sometimes does occur and other times it does not. In the case of particulate matter and Congestion Charging closure on the meaning of technology has occurred, but in the case of Virtuocity in Helmond closure on the meaning of technology did occur but in Tilburg it did not. This can be explained by the application itself where the government of Helmond kept the application simple closure on the meaning of technology has occurred. In Tilburg the subject very quickly became politicized and closure on the meaning of technology has not occurred. The simpler the goal of the application, the more likely closure on the meaning of technology occurs. The case of particulate matter demonstrates that when more than one actor has access to the data it becomes impossible for one actor to use the application over another actor, all actors consider the technology untrustworthy. Making the application open to all could therefore increase the likelihood of closure on the meaning of technology occurring. Congestion Charging shows us that the subject might have become much politicized, the technology has not, and all consider the application a neutral tool.

Channel from Technology to the Action Arena

The third channel moves from technology back to the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992). What we see in this channel is that whether closure on the meaning of technology has occurred or not, the meaning given to the GIS, either by all coalitions or for each separate coalition influences the actions in the action arena. Mostly this is seen in terms of power, those with access to the data and the application gain power and behave as such. Others regard this as a threat to their own power and behave accordingly. Since in the case of particulate matter several coalitions have access to the data and the application, we see a very hostile environment in which power relations are unclear.

Linking this back to the case studies in the case of Virtuocity this comes forward. In Helmond, closure on the meaning of technology has occurred, in the action arena there is little conflict. In Tilburg there is no closure on the meaning of technology and there is a lot of conflict, due to the fact that some consider Virtuocity as a tool from the government to deceive them. Here Virtuocity mostly empowers those in government since they decide on how to use the application.

For particulate matter we can notice that because of the distrust in the technology the way actors act towards each other is at best questionable, hostile at worst. This hinders the design of a policy in which all coalitions can find their ideas. The application is used by each actor to increase its power over another actor. A problem is that this causes a situation in which in all policy designs on spatial planning there is a winner and a loser. Either the plan will continue or it will not.

In the case of Congestion Charging we see the technology is seen as a calculation device and it benefits those in favor of the charge, since they hold all the information. In the action arena we see that this indeed is the case and that the actors behave accordingly.

Channel from Technology to Structure

Finally there is the channel from technology to structure. After the actors in the action arena have shaped technology and closure on the meaning of technology occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). It can be said that GIS, by their functions and effects of calculation, integration, visualization, communication and transparency, and by the actions in the action arena, eventually can influence the structure. Making sure new laws are made on the basis of the outcomes and possibilities of the GIS. New power relations emerging from the use of GIS are embedded in rules in use and culture. In the case studies individually we can find this. In the case of Virtuocity this has happened in Helmond. After the first use of Virtuocity it basically became a rule in use to place all redevelopments into Virtuocity making sure participation by the public is granted and communication on these plans becomes a common practice. In Tilburg this is not the case, partly due to the large amount of conflicts and the culture of distrust.

In the case of particulate matter we see that the technology does have influence on the structure. We can see that the rules in use have clearly changed, there exists a culture of distrust, and this makes it very difficult for municipalities to balance economic interests with air quality measures.

Finally in the case of the Congestion Charge the technology is seen as a legitimate, trustworthy tool for calculation so laws based on the information gathered with the technology are trusted as well. Since Transport for London is the organization holding the technology they now have a large amount of power in the making of legislation. This also reflects on the rules in use, the rule that Transport for London does not have to consult with others a lot is reinforced by the fact that they hold the technology. Culture in this case does not seem to be influenced as of yet.

13.4.3 Conclusion

After looking at the different variables separately of the conceptual framework of policy design and the three parts and the four channels of interplay we can draw some conclusions on what this means when dealing with policy design while using GIS.

When looking at the course of the process of policy design we can conclude several variables are influenced by the use of GIS which affect the course of the process of policy design. The bounds of rationality influence the course in the way that they have decreased by the use of GIS. It becomes clear that through this decrease in the course of the process actors are now able to communicate more easily with one another and through visualization can explain issues that formerly could not be explained. For power we see a change. Due to the use of GIS power relations shift, those with access to the data and the application clearly gain in relative power, since they are the ones deciding which calculations to make and what information to show and share. This influences the course of the process since some actors have gained power and some have lost power, and are thus less able to push their ideas forward. For conflict the same goes, through these shifts in power new conflicts arise because of the use of GIS. These conflicts can be seen in terms of participation and exclusion, legitimacy of calculations and norms, proper communication and social values. When looking at the formal institutional features we see the same as for agenda-setting. It really matters who initiated the application. When the application was initiated by government the application is institutionally embedded. Together with the initiation of the application the government has made sure the application was laid down by law and the laws needed to facilitate the application were made in advance. This affects the power relations even further, if those with access to the data and the application are legally the ones who ought to be doing this they gain in power even more. The rules in use have an impact on the course of the process as well; the rules in use account for the way the actors in the course of the process behave towards one another. By the use of GIS these rules in use might be altered, due to trusting nominal numbers or due to power relations changed by the use of GIS. Finally culture has an impact on the course of the process of policy design. The leading culture can often account for how GIS are perceived and communicated. A present culture dealing with risk aversion, due to the bounds in rationality, a culture of distrust but also a culture of trusting numbers, politicization and the familiarity with an issue matters significantly. The course of the process of policy design is adapted by this culture.

For the content of the process of policy design the same thing can be concluded. The bounds of rationality come forward very clearly. Since the bounds of rationality have decreased the content changes. Due to the calculations and increased transparency it is often easier to explain and communicate what the issue actually entails. When looking at the content of the process of policy design satisficing does matter. The content is often less than optimal since the calculations are not trusted, and the consequences of alternatives are unknown. For power and conflict the same goes as for the course of the process, those with access to the data and the application clearly gain in relative power, since they are the ones deciding which calculations to make and what information to show and share. Here as well it is seen that power mostly stays with those already in power. It is also seen that in all cases power shifts towards experts where this power was formerly with politics. Now experts are deciding on content where before the use of GIS this was reserved for politicians. The formal institutional features have the same effect as they had in the course of the process. When the government initiated the application the application is embedded by law. This gives those with access the legal power to decide over content. This goes for the rules in use as well. For culture the same can be said as before, the leading culture will affect the content of the process of policy design since risk aversion, distrust, trusting numbers, politicization and the familiarity with an issue will have a large effect on what the content will be.

Finally for the outcome of the process of policy design these variables also matter. The decrease in the bounds of rationality due to the use of GIS can account for a different outcome. This is so because new information is visible, can be explained and simulations are possible. The increase in the bounds of rationality can also influence the outcome. When numbers are not trusted or the consequences of the application are unclear the outcome can be adapted to this. For satisficing it was demonstrated a sub-optimal outcome is often chosen. Because numbers are not always trusted and there is some fear for the new application this might be translated in the outcome, making sure the outcome is different than it would be without using GIS. For power the same goes as for the course and the content, now while some actors have gained power over others they will be able to see more of their ideas back in the final outcome. The formal institutional features and the rules in use enforce this. When the application and the laws making it possible are institutionally embedded these actors gain even more power which makes sure they can push their ideas forward more fiercely. Culture finally also impacts the outcome; this because the leading culture will partially determine which alternative is acceptable in terms of risk aversion and distrust.

Secondly the three parts and the four channels of interplay show us a number of issues. Firstly it is very important for the course, the content and the outcome, who has access to the application as well as the data; this is seen within the action arena. Those with access are able to use the calculation, visualization and communication solutions of GIS, they can also decide who to communicate this data to and how. They therefore have a clear advantage in pushing their issue forward towards policy design. This in terms of the course of the process, they gain power while others do not. In terms of the content of the issue, they have the information so they have greater power in defining the content and in terms of outcome since they have far more chance for their ideas to reach the final policy. In the case of particulate matter it becomes clear when more than one coalition has access to both data and application it is not clear who holds the most power and this shifts per situation.

Secondly we see that the structure influences the actions within the action arena. Here it is very important who initiated the design of the GIS. The initiator benefits from the

GIS since it serves the initiators interests. When the government initiates the design of the application we see that the application is institutionally embedded, giving those with access even more power and granting them legitimacy, since they are the ones who formally ought to work with the application. This is important in terms of course of the process of policy design because it will grant some more power than others. This goes for the content as well as for the outcome. Furthermore the rules in use influence policy design as well. It becomes clear the rules in use account for the way actors perceive the GIS. Finally culture does the same, a culture of risk aversion and distrust limits the power one could obtain while using the GIS, this influences the course, the content and the outcome of the process of policy design.

Thirdly it is important to look at closure on the meaning of technology, sometimes it occurs and sometimes it does not, this can be explained by a number of factors. Firstly the scope of the application is important, an application with a lot of different functionalities will reach closure on the meaning of technology far less quickly than an application with little functionalities. Secondly the subject itself is important; a highly politicized subject will less likely reach closure on the meaning of technology than a subject which deals with little political values. Thirdly it is important who has access to the data and the application. As the particulate matter case shows when more than one actor has access to the data it becomes impossible for one actor to use the application over another actor. Making the application open to all could therefore increase the likelihood of closure on the meaning of technology occurring. Even though closure on the meaning of technology is important in having all actors viewing the technology the same way, it does not influence the process of policy design.

Fourthly and linked to the third point is that it is very important for the process of policy design how the GIS, whether closure on the meaning of technology has occurred or not, is perceived by the actors in the action arena. Mostly this is seen in terms of power, those with access to the data and the application gain power and behave as such, while others regard this as a threat to their own power and behave accordingly. The case of particulate matter demonstrates that when several coalitions have access to the data and the application a very hostile environment can be found in which power relations are unclear. This influences the course, content and outcome of policy design since it is unclear for all actors where they stand, how fierce they can push their issue forward and what to expect.

A final conclusion can be drawn on the point whether GIS once shaped can influence structure. We clearly see this happening. This influencing of the structure will have a strong effect on the course, the content and the outcome of the process of policy design. Once power relations are institutionally embedded and laws are made, the action arena will react to this. The new power relations and the new laws will influence the process of policy design, again mostly in terms of power.

13.5 A SECOND ARENA, DESIGNING THE APPLICATION

As was demonstrated in each case study, next to the agenda-setting arena and the policy design arena a second arena emerges simultaneously. What has happened is next to pushing issues forward to agenda-status and policy design a new arena emerged in which the issue at stake was not the subject but the technology itself. This arena has dealt with whom to grant access, what to include in the application and what the features of this application should be. The issues dealt with in this second arena could not be incorporated into the first arena because there are different actors with different interest at stake but also because the content on the issue itself is different. Therefore, next to the agenda-setting arena and policy design arena on the policy issue itself a second arena had emerged, the arena in which policy is designed on how to design and implement the applications itself.

This has been backed by theory on implementing information systems within organizations. Here it is claimed that implementing information systems in organizations can be very difficult, because there are different stakeholders and departments within the organization. They fear that the new information system will compromise their autonomy and control. Those stakeholders who think they will lose autonomy will resist the new application and those who believe they will gain control will be in favor of the application (Markus & Robey, 1983; Goodhue et al., 1992).

In this section the second arena will be dealt with for all case studies. This arena is an arena of policy design as well, in this arena the policy on the application itself is designed. This arena will be treated the same way as the other arenas, first the variables, the building blocks the conceptual framework of policy design will be discussed and later on the conceptual framework itself.

13.5.1 Concepts of Policy Design

First the building blocks of the conceptual framework will be dealt with before moving forward to the actual conceptual framework of policy. First bounded rationality will be dealt with, next satisficing, thirdly conflict of values, fourthly power, fifthly the formal institutional features, sixth the rules in use and finally culture. An overview of each case is given in table 13.8.

Bounded Rationality

The first building block is bounded rationality. Bounded rationality is the idea that humans cannot account for all possible alternatives, predict all possible consequences and refer to all possible costs and benefits (Simon, 1957; 1976; March, 1994; Lindblom, 1959; Etzioni, 1967; Dror, 1968).

Here it can be found that even though GIS can account for a decrease in the bounds of rationality in policy design, in the designing of policy on which application to use

Table 13.8: Variables of Policy Design

	HIS/FLIWAS	The Riskmap	TSN	Virtuocity	Particulate Matter	Congestion Charge
Bounded Rationality	Decreases due to being unable to predict consequences.	Decreases due to being unable to predict consequences.	Decreases due to being unable to predict consequences, exclusion of some and margins of error in calculations.	Decreases due to being unable to predict consequences.	Decreases due to being unable to predict consequences and margins of error in calculations.	Decreases due to being unable to predict consequences.
Satisficing	Satisficing on the points of integration and communicating.	Satisficing on the points of sharing all information and on comprehen-siveness over completeness.	Satisficing on the points of communicating and on comprehen-siveness over completeness.	Satisficing on the application itself because time and money are pressing.	Satisficing on the points of integration.	Satisficing on the application itself because time and money are pressing.
Conflict of Values	Conflict on autonomy, who to communicate information to, fear of losing power.	Conflict on whom to communicate information to, fear of losing power, completeness versus comprehen-siveness.	Conflict on autonomy, who to communicate information to, fear of losing power, completeness versus, comprehen-siveness, trustworthiness.	Conflict on fear of losing power, completeness versus comprehen-siveness.	Conflict on whom to communicate information to, fear of losing power, trustworthiness.	Conflict on fear of losing power, completeness versus comprehen-siveness.
Power	Power in the design of the application stays with those who initiated the application.	Power in the design of the applications stays with the government, leaving no room for opinions of others.	Power in the design of the application stays partially with those already in power and for the other part moves to experts.	Power in the design of the application stays partially with those already in power and for the other part moves to experts.	Power in the design of the application stays partially with those already in power and for the other part moves to experts.	Power in the design of the application stays partially with those already in power and for the other part moves to experts.

Table 13.8 continued

	HIS/FLIWAS	The Riskmap	TSN	Virtuocity	Particulate Matter	Congestion Charge
Formal Institutional Features	Formal institutions hinder the process because of fragmentation and the absence of legislation.	Formal institutions help the process because the law was laid down but hinder because of fragmentation.	Formal institutions help the process because the law was laid down, and little fragmentation existed.	Formal institutions hinder the process because of lack of legislation but little fragmentation helped.	Formal institutions help the process because the law was laid down and there is little fragmentation.	Formal institutions help the process because the law was laid down and fragmentation did not exist.
Rules in Use	Rules in use do not benefit those in power and the rules where not laid down beforehand.	Rules in use are laid down and those in power benefit from them.	Rules in use are laid down and those in power benefit from them.	Rules in use are laid down and those in power benefit from them.	Rules in use are laid down and those in power benefit from them.	Rules in use are laid down and those in power benefit from them.
Culture	Culture of a history with the issue influences the process.	Culture of holding everything in ones own hands and culture of risk aversion influences the process.	Culture of a history with the issue and culture of holding everything in ones own hands influences the process.	Culture of risk aversion influences the process.	Lack of a culture of history with the issue and culture of holding everything in ones own hands influences the process.	Culture of holding everything in ones own hands influences the process.

and how to use it, the bounds of rationality only increase. This is due to the fact that the application is new. Consequences cannot be predicted in terms of reactions of citizens and other layers of government, accountability issues, insecurities in calculations, in- or excluding groups and costs of the technology.

When linking this back to the individual case studies we can see in the case of HIS and FLIWAS first of all the question of whether certain parts of HIS, and especially the movies, should be available for the public. The fear that indeed governments will be held accountable for not doing anything about the risk of flooding is present. These bounds are also present in the case of the Riskmap. Municipalities had not dealt with this kind of risk communication towards citizens before and citizens never had the opportunity to see all potential dangers of their surroundings in such an easy way. Municipalities were not sure what to expect from citizens. Finally the bounds of rationality in the beginning phase of the Riskmap clearly increased on the subject of terrorism. Some feared that when all this information would be available on the Internet for everybody to see from their own home that terrorists would use this information and there could be serious problems.

In the case of contagious live stock diseases we see an increase in the bounds of rationality on the side of the experts without access to TSN, because they do no longer have the information they used to have. The data is seen as trustworthy and up-to-date but the calculations made in scenario sketching are not.

In the case of Virtuocity, local governments were very limited in their ability to predict consequences of the use of Virtuocity; they were unclear on what the costs and benefits would be. The reason for this can be found in the notion that an application like Virtuocity had no precedents in the Netherlands. Therefore there were no results present for governments to analyze.

In the case of particulate matter we also see an increase. Firstly there are the exceptions on the law. Policy-makers at first did not hold into account what the consequences were of the newly implemented law. Furthermore we see the bounds of rationality back in the sheer fact that we are unable to calculate outcomes of measurements and their effects with any precision.

Finally in the case of Congestion Charging we see a clear increase in the bounds of rationality. In this arena the only question actors had to deal with is which technology should be used, would it be CCTV, Tag & Beacon, GPS with satellites or GSM technology. Transport for London was very clear on using CCTV while others claimed Tag & Beacon would be the best choice. Linked to this is the increase in the bounds of rationality since it was very unclear what the effect of each technology was, and how this technology should be implemented. Furthermore the costs of any of these technologies were unknown.

Satisficing

The bounds in rationality add to the practice of satisficing. Instead of searching for an optimal solution a satisfactory solution is chosen (March, 1994). Here we see that in all cases a solution is chosen which is not optimal, satisficing occurs because of four reasons, firstly because integration can not always be established due to autonomy issues; secondly because communicating all information cannot always be achieved because of fear of consequences; thirdly because the balance between complete information and still remaining understandable without being overloaded is very difficult and finally because time and money are pressing.

When looking at the individual case studies we can find this. In the case of HIS and FLIWAS policy-makers but also the water sector itself had to lessen the ambition of integration somewhat and choose for a less than optimal solution. This comes forward in the case when the German water management sector uses another communication module in FLIWAS than the Dutch water management sector. The Dutch and the Germans had to compromise on this and had to settle for a satisfying compromise. Another point is that most of the water management professionals would like to have the information HIS generates available for the public; this is not yet the case.

In the case of the Riskmap we see that the national government had to balance between the completeness of the Riskmap and accessibility; this not in terms of technical accessibility but in terms of accessibility in comprehension for the public. The government chose to make the map as accessible as possible. The government had a difficult time compromising and chose for a satisficing solution simply because an optimal, in this dilemma, was not to be found. Furthermore we see that the provinces and the municipalities had to settle for a satisficing solution in the matter of the affect-distances. They wanted them to be on the public map but the Ministry of Internal Affairs, pressured by the Ministry of Economic Affairs, decided not to do so.

In the case of contagious live stock diseases there actually are some instances of optimality, a large group of experts with access to TSN believes the way TSN operates at this point is the way they indented it to operate. On the other hand there are some who believe TSN is not optimal at all. Firstly these are the experts without access to TSN, they believe they should have access which in their vision makes TSN a tool for pushing only one groups opinion forward. Secondly there is a group of experts in another field than containing live stock diseases who believe TSN should be expanded.

In the case of Virtuocity a satisficing solution was implemented in both cities. The reasons for this was first the notion consequences could not be predicted and costs and benefits were hard to calculate; secondly risk averting behavior constituted for this as well. For Tilburg time was also pressing so searching for alternatives even longer would prolong the process. The government of Tilburg wanted an application available to all people but had to settle for a heavier application with a higher resolution to make sure the design was visualized properly.

In the case of particulate matter we see that in implementing the different applications for the different municipalities that even though we would like to have one clear way of calculating we do not. All municipalities are able to insert data over and over again with slightly different calculations and in this way producing an outcome. Since one application in which this is not possible is not present today, this is simply accepted.

Finally in the case of Congestion Charging a very clear case of satisficing is to be seen when Transport for London had to come up with a technology in very little time so the Congestion Charging scheme could be implemented. The technology chosen had clear inaccuracies which were known to Transport for London but since time was pressing they settled for this technology.

Conflict of Values

A third important concept, conflict of values, can also be found in the arena of implementing and designing the applications (Etzioni, 1967). When comparing the cases it can be found that in all cases several conflicts of values arise when designing the application, these in terms of autonomy, when integration issues are at stake, who to share and communicate information with, fear of losing power to other actors because of the design of the application, completeness versus comprehensiveness and finally in the trustworthiness of the technology itself.

This can be found back in the cases individually. In the case of HIS and FLIWAS there was some conflict. The most obvious of these was the conflict between the Dutch and the German water sector on which application would be used as communication module in FLIWAS. Where this started of as merely a financial consideration this moved forward becoming an issue of autonomy of both sectors. Secondly the conflict of whether the public should be informed on the information calculated by HIS constituted for a conflict. Thirdly, it was so that a conflict was present between the water management sector and the local and provincial authorities. While using HIS and FLIWAS, the water management sector would have a very powerful tool with which they would be able to push their ideas on how to design the public space forward very strongly. The local authorities feared that they would lose some of their authority.

In the case of the Riskmap conflict is present on how to deal with potential terrorist threats now they could obtain this information in such an easy way. Furthermore we see a conflict between the municipalities and all other parties. The municipalities feared that by putting all the risks on the map to see for the public, the public would complain about everything. Finally the conflict on the affect-distances which proved to be the largest conflict. The value of informing citizens conflicted very hard with economic values. The main fear was that international businesses would move their business elsewhere or not consider the Netherlands when expanding.

In the case of contagious live stock diseases three conflicts stand out in the implementation of TSN. Firstly the conflict on who is granted access to TSN, only the Tierartzenkammern, the Friedrich Loeffler Institute and some smaller organizations were granted access and other organizations were not. This caused conflict since those without access demanded access and those with access were not very willing to share their newly found power. A second conflict is not about who is included into TSN but what is included into TSN. Some experts would like to expand TSN from not only an agricultural application to nutrition and consumer protection application. The experts with access to TSN do not wish to do so. A third cause for conflict is the insecurities and the margins of error in the calculations within TSN.

In the case of Virtuocity in Helmond little conflict occurred. In Tilburg the situation was different. In the process of designing policy for Virtuocity first there was a conflict of values between CEBRA and the city of Tilburg, firstly in the matter of whether to have a forum and a chat, secondly in the balancing of priorities. The government wanted accessibility to be a priority CEBRA wanted a high resolution to be a priority.

In the case of particulate matter there was the conflict between environmental organizations and the government, local as well as national. Here we see that environmental organizations want the public to be more involved in the applications.

Finally in the case of Congestion Charging we see several conflicts. The first conflict was again on which technology should be used. Another conflict is the conflict whether the data of established neighborhoods should be into the GIS application to make sure neighborhoods were not divided by the charge. Transport for London at first did not do so because they simply did not think about it, which aggravated citizens.

Power

Linked to conflict of values, power is an important concept in the conceptual framework since it can be used by actors to push their solution forward over another actor's solution (Etzioni, 1967; Dahl, 1961). Here we see when comparing the case studies that the design of GIS itself shows that power relations influence this process. Those with access to the data and the application clearly gain in relative power; they decide how to design the application and often do not consult with others. In five cases it is to be seen that power mostly stays with those already in power in accordance with the reinforcement thesis (Kraemer & King, 1986), except for HIS en FLIWAS. This might be explained by the fact that those in power did not initiate the design of the GIS, so power on the design stayed with the initiators. Further in four cases power shifts towards experts where this power was formerly with politics, in accordance with Winner's thesis (Winner, 1991), except for the cases of the HIS and FLIWAS and the Riskmap. For HIS and FLIWAS this can be explained by the idea that this power has been with experts for a long time, in the case of the Riskmap the government did not give experts any room to take this power.

Looking at the separate case studies we see that in the case of HIS and FLIWAS the technicians did not gain any power over the other participants in the project. The public does not account for a powerful group either. As far as the other parties are concerned we can clearly see the water management sector with HIS and FLIWAS would gain a lot of power over local and provincial authorities. However, the water sector itself in the design process of HIS and FLIWAS fails to form a single block of power.

In the case of the Riskmap the municipalities in their fear citizens would keep complaining about every single risk had no real power to do something about this. Furthermore the first aid agencies and risk management professionals did not have any real power to make sure the professional Riskmap was developed earlier. Technicians did not have any say in the design process of the application; they had to do what they were told and were not in the position to make adjustment or alterations. This also counts for citizens. All the instances mentioned above can be brought back to one simple point: while the national government needed to do something quick after the disaster in Enschede they just made the plans for the Riskmap. Little debate and negotiation went on between the national government and other parties before the law was literally laid down.

In the case of contagious live stock diseases we see first the enormous shift in power TSN caused between experts. Those with access to TSN have the monopoly on information and government communication. Power struggles are not to be seen, The European Union asked for an application for information, prevention and containment of contagious live stock diseases, and demanded this to be implemented. The federal German government as well asked for TSN and wanted the Friedrich Loeffler Institute to design it. Room for discussion was impossible.

In the case of Virtuocity the power relations in the design process of the technology come forward in both cities. Most power stays with the government. In Helmond this is very clear since the city of Helmond formally takes the final decisions, even though they take opinions from citizens into account they still make the final decision. In Tilburg citizens were no part of the policy design process for Virtuocity. CEBRA also holds a large deal of power. It was able to influence the government by pushing forward to extend the web application and persuade the city of Tilburg to include a forum and a chat in the design.

In the case of particulate matter the national government and the European Union still hold a large deal of power. Here it is decided on the norm and how to deal with this norm. They have also decided on how applications should look, even though municipalities have a choice in which application to use. The scientific community also has a large deal of power in this matter. They decide how to appropriately calculate the concentrations of particulate matter and what the outcomes mean. The technicians who develop the applications by which the measurements and calculations are made hold a large amount of power.

Finally in the case of the Congestion Charge we see that Transport for London was delegated all power to design the technology and use it the way they saw fit. This left all other actors powerless. Furthermore, this was delegated to Transport for London by the Labour party, in this way also holding power, and leaving the Conservative party with no means of influencing the process of designing the technology.

Formal Institutional Features

Moving towards the structure side of the conceptual framework of policy design first of all the formal institutional features must be discussed (Ostrom et al., 1994). Here we see that the formal institutions thus can both help and hinder policy design while designing the GIS application. In cases in which the application was laid down by law the application helped policy design since here it was clear what is allowed and what is not. Secondly when there are many organizations to deal with, formal institutions hinder policy design in designing the application. Since in most cases the reinforcement thesis can be applied it follows that when those already in power initiate the application the formal institutions will help that application. Only for the case of HIS and FLIWAS this was different but this is because the ones to initiate the application were not those in power.

When looking at the case studies individually this stands out. In the case of HIS and FLIWAS we see two issues. Firstly, institutionally there are a lot of different organizations dealing with water management and flooding risks, this makes the water sector very fragmented. Since there are so many organizations dealing with water management it became very hard to have them all look in the same direction. Corresponding with this is that there are so many organizations, next to the water management sector itself, which have to deal with water management and flood risks that communication became very difficult.

For the Riskmap it can be said the formal institutions helped the implementation of the Riskmap by making sure there were few real conflicts. The national government made regulations and law very quickly; there was little room for debate and negotiations on headlines afterwards. This made the implementation of the Riskmap to move very smoothly, room for argument was simply absent. What must be said however is that the organizational structure of risks and risk communication made the implementation difficult. Where in the Netherlands before the Riskmap there were a large number of organizations which held information about risks and had a stake in the Riskmap, all these organizations had to be involved in implementing the Riskmap. All the data had to be standardized into one application.

In the case of contagious live stock diseases we see that as far as the formal institutional features are concerned these helped the implementation of TSN. The European Union as well as the German federal government wanted an application able to hold a large database, calculate, predict and log. The implementation of TSN therefore moved very smoothly since there was no room for discussion. The German federal government delegated to the Friedrich Loeffler Institute to decide on the specific form and contents as long as it fitted the goal.

In the case of Virtuocity formal institutions made this kind participation possible. On the other hand formal institutions hindered a formal referendum in the city of Tilburg because of exclusion issues and the impossibility to prevent fraud. There are no regulations on how to deal with this, which made the design process more difficult.

In the case of particulate matter we see that within the implementation process formal institutional features have a very large impact. All the rules and features of the applications, the calculations and the measurements are laid down by law, either national or European. Even though local governments are allowed to choose an application they are not allowed to choose an application which does not meet the requirements made by law. The rules made for exceptions in the particulate matter case are laid down by law, but only after the original rules were implemented. This is so because consequences were unforeseen at the time of the implementation of the original law.

Finally in the case of the Congestion Charge the formal institutions helped a smooth and quick design of the technology. Since Transport for London had all the power to decide on the technology little discussion was possible and they used the technology as they pleased.

Rules in Use

Additional to the formal institutional features the informal rules are very important as well, the rules in use (Ostrom et al., 1994, Stone, 1997). The rules in use have a large impact on how actors deal with the design of the GIS, how perceive it and how they would like to implement it. It is important to see whether the rules in use are already laid down and the rules in use on with whom to negotiate. This matters to a large degree on how the application will be designed. Only those invited to negotiate will have an influence on the design. Only in the case of HIS and FLIWAS this was not decided by those in power, so this is the only case in which the rules in use do not benefit those in power.

In the case studies this can be demonstrated. In the case of HIS and FLIWAS we see in the design of HIS and FLIWAS the rules of Rapid Design Application applied, making a demo and then adapting to the users needs. This helped implementation severely.

In the case of the Riskmap there are two rules in use to be discussed. Firstly one of the rules in use in the implementation of the Riskmap was that the national government had laid down everything by law already and that little discussion was possible. Secondly, even though little discussion was possible there would not have been a lot of discussion to begin with. All parties seemed to share a view on what risk communication with the Riskmap should entail.

In the case of contagious live stock diseases we see that an application like TSN was obligatory. Discussion on the right of existence of the application and its headlines was impossible. The Friedrich Loeffler Institute had always been the prime organization dealing with this, it communicated with the German federal government and held the information and the newest research.

In the policy design process on Virtuocity it becomes clear nothing was laid down by law and negotiations only occurred between the government and CEBRA, leaving the architects and citizens far from the negotiation table.

In the case of particulate matter the rules in use in this arena can be viewed as fairly simple. The rules in use are simply to obey the law in the process of implementation. The law was made and discussion on how to implement was not possible anymore. New rules in use have not emerged in the process of implementation. Another rule in use at present is not to include the public in these matters to a large degree, information to the public is often difficult to understand and effects of particulate matter are unclear to most people. According to the environmental organizations this should change.

Finally in the case of the Congestion Charge for the rules in use the same goes as in the formal institutions; since Transport for London did not have to debate their decisions on the technology with others it was very easy to design policy on the technology as they seemed fit.

Culture

The final building block is culture (Ostrom et al., 1994). When comparing the cases it can be seen that culture has a large impact on how the design process of GIS is perceived and implemented. Here we see that risk aversion, due to the bounds in rationality is present, a culture of dealing with the issue, and a culture of holding all rules in ones own hand have a very large impact on the designing of the application.

In the case studies individually it can be found that in the case of HIS and FLIWAS a culture of risk aversion on the side of the local and provincial authorities and the Ministry of Internal Affairs can be found. Because the consequences were not clear to them of giving the public access to HIS they prevented this from happening. Furthermore in the Netherlands there is a culture in which water management issues have always been very much present. Dealing with water and risks of flooding has historically been one of the basis tasks of the Dutch government. Therefore an application like HIS and FLIWAS seemed a logical step to most government agencies. This made implementation a lot easier.

In the case of the Riskmap there was a clear culture of the national government to hold everything in their own hands. They had laid everything down by law and discussion was not an option for other parties. We also see a culture in which it is made sure to inform the public on risks and potential dangers. In the municipalities we also see a culture of risk aversion, they feared citizens would complain about every risk and they were not sure about the consequences of this. They were not able to predict whether this might happen and to what extent.

In the case of contagious live stock diseases there was a clear culture of the German federal government and the Friedrich Loeffler Institute to hold everything in their own hands. They had laid everything down by law and discussion was not an option for other parties. It is very important in the process of implementation of TSN that contagious live stock diseases make an issue which the Germans have dealt with for centuries. This long culture and long history of dealing with the issue made implementation easier and made sure that little discussion took place.

In the case of Virtuocity risk averting behavior on the side of the governments proves to be a large factor. Since GIS are fairly new, consequences of policy are not very easy to predict The two cities therefore did not execute the complete plan because they feared the risks.

In the case of particulate matter there is a culture present in which all the issues on the application are laid down by law and the government does not want to give this out of hands. A lack of a culture of dealing with this issue has not helped the design process.

Finally for the case of the Congestion Charge we see Transport for London held everything in its own hand and did not negotiate with others.

13.5.2 The Influence of GIS in implementing

Like we have done for the other arenas, after looking at the variables making up the conceptual framework of policy design, the conceptual framework of policy design can be looked at in relation to these cases.

As mentioned in the case studies the conceptual framework of policy design consists out of three parts and four channels of interplay. First the three parts will be discussed since these three parts are very case specific they cannot be compared. Therefore they will only be discussed for the means of overview. The four channels of interplay can be compared and will be discussed. An overview of the comparison will be given in table 13.9.

The Action Arena

The action arena is the space in which all involved parties interact. They try to push their ideas forward within their technological frame (Orlikowski, 1992; Orlikowski and Gash, 1994; Bijker, 1995 Berger and Luckmann, 1966; Weick, 2001; Searle, 1995). The technological frame holds the assumptions, expectations and knowledge about the purpose, context, importance and role of technology by a certain group of actors. They then use their relative power to aim for a satisficing solution and they do so within the bounds of their rationality (Lindblom, 1959; Etzioni, 1967; Dror, 1968; Simon, 1957; 1976; March, 1994).

Table 13.9: Conceptual Framework of Policy Design

	HIS/FLIWAS	The Riskmap	TSN	Virtuocity	Particulate Matter	Congestion Charge
Structure to Policy Sub-System	Structure hinders policy design due to fragmentation. A history of dealing with the issue helps.	Structure helps policy design since all was laid down by law. A culture of risk aversion hinders the process.	Structure helps policy design since all was laid down by law.	Structure helps policy design since all was laid down by law. A culture of risk aversion hinders the process.	Structure helps policy design since all was laid down by law.	Structure helps policy design since all was laid down by law.
Policy Sub-System to Technology	Closure has not occurred.	Closure has occurred.	Closure has not occurred.	Closure has occurred in Helmond but not in Tilburg.	Closure has occurred.	Closure has occurred.
Technology to Policy Sub-System	The shaping of technology makes sure the water sector gains power.	The shaping of technology makes sure that those in power stay in power.	The shaping of technology makes sure that those in power stay in power.	The shaping of technology makes sure that those in power stay in power.	The shaping of technology makes sure that those in power stay in power.	The shaping of technology makes sure that those in power stay in power.
Technology to Structure	Technology influences structure since the water sector gained power in rules in use.	Technology does not influence structure.	Technology influences structure since some are now excluded which were formerly included.	Technology does not influence structure.	Technology does not influence structure.	Technology does not influence structure.

When looking at the case studies we can see a lot similar to the first arena. Only minor differences can be distinguished. Therefore only those differences will be discussed. In the case of HIS and FLIWAS the designer of the application Royal Haskoning plays a larger part in this arena. In the case of the Riskmap the public is not included in the action arena of this arena. This is also the case for Virtuocity, particulate matter and Congestion Charging. For the rest the action arena and the power relations within remain the same as in the first arena.

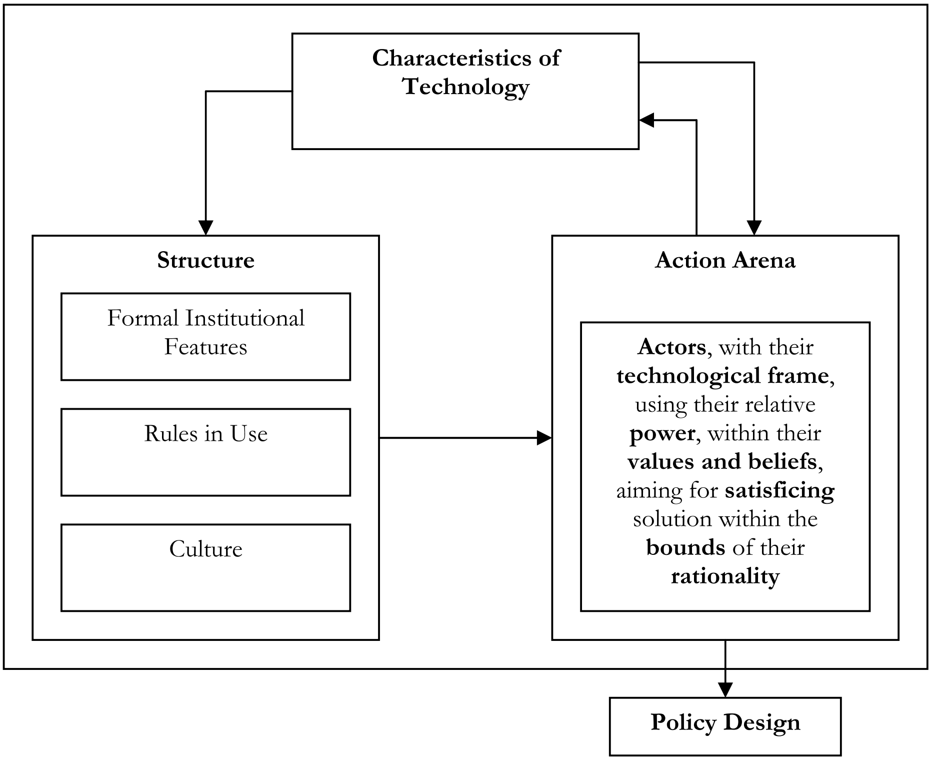

Figure 13.3: The Conceptual Framework of Policy Design

Technology

The second part of the conceptual framework for policy design deals with the characteristics of the technology itself. Here it is important which meaning GIS have been given and whether closure on the meaning of technology and stabilization have occurred. (Bijker, 1995). In the second arena there is not much different in this part either, closure on the meaning of technology has occurred in the cases of the Riskmap, Virtuocity in Helmond, particulate matter and Congestion Charging and closure on the meaning of technology has not occurred in the cases of HIS and FLIWAS, TSN and Virtuocity in Tilburg. The explanation for this difference has been discussed earlier.

Structure

The final part of the conceptual framework is structure; this includes the formal institutional features, the rules in use and culture (Ostrom et al., 1994). These can help or hinder the actors in the action arena, they influence the scope of actions possible. For the formal institutional features it can be seen in the HIS and FLIWAS case that the action arena is more complicated. There are a lot of actors and most groups of actors are able to use their power against other groups. Because of the fragmented character of the Dutch water sector, the groups internally do not form a coalition.

In the case of the Riskmap the formal institutions helped implementation of the Riskmap and in that way in the first place favored the national government while they laid down the law and thus had the power to set down the rules before other parties joined in.

For TSN it can be said the formal institutions helped implementation of TSN and in that way in the first place favored the German federal government while they laid down the law.

In the case of Virtuocity the formal institutional features hinder applications like Virtuocity and make the use of the full potential of the application very difficult.

For particulate matter the formal institutions have limited conflict in the action arena, since all was decided on already either by European Law or by national law there was little room to negotiate.

Finally for Congestion Charging the formal institutions have made sure Transport for London had this kind of power to begin with. So the formal institutions made sure conflict was limited since the other coalition had no real power to stop any design.

Secondly the rules in use complicate these matters even further (Ostrom et al. 1994). In the case of HIS and FLIWAS again the lack of communication within the water management sector but also between the water management sector and other sectors hinder negotiations in the action arena.

For the Riskmap the rules in use do the exact same as the formal institutions have, as well as for TSN, particulate matter and Congestion Charging.

In the case of Virtuocity the rules in use account for how both local governments interact with CEBRA. In Helmond there was a large amount of trust, Tilburg wanted to keep matters in its own hands.

Finally there is culture to be dealt with (Ostrom et al., 1994). In the case of HIS and FLIWAS risk aversion hindered the public of getting access to the information of HIS and FLIWAS The culture of dealing with water management issues generated the means needed in the action arena.

In the case of the Riskmap the culture is correspondent with the institutional features and the rules in use, except for the culture in the municipalities of fear. Since they had no real power to change this it did not complicate the matter.

The case of TSN shows the culture is coherent with the institutional features and the rules in use, the law was laid down. Furthermore we see a culture of believing hard numbers are true, this makes sure TSN is trusted. A long history and culture of dealing with contagious live stock diseases made sure implementation moved very smoothly.

In the case of Virtuocity culture shows risk averting behavior is very determining for the actions in the action arena. Since consequences of the use of Virtuocity could not be predicted, both local governments were reluctant to implement the application with all its functions.

In the case of particulate matter the culture of trusting nominal numbers is present as well.

And finally in the case of Congestion Charging we see even though the issue is very politicized still the actions in the arena are limited to making sure Transport for London has a lot of say and other actors do not.

Channel from Structure to the Action Arena

After dealing with the three parts of the conceptual framework now the four channels of interplay can be dealt with. Firstly there is the channel moving from the structure to the action arena. Here the action arena is influenced by the three parts of structure, the formal institutional features, the rules in use and culture. The structure can both help and hinder policy design and is partly dependent on the use of GIS.

When comparing the case studies in this arena three points stand out. Firstly in cases in which the application was laid down by law the application helped policy design since here it was clear what is allowed and what is not. The only difficulty here is when there are many organizations to deal with and to organize them all. Secondly the rules in use mostly reinforce this. Thirdly culture has a large impact on how GIS are perceived, used and communicated. Here we see that risk aversion, due to the bounds in rationality is present, and in some cases a culture of dealing with the issue, have a very large impact on the designing of the application.

Channel from the Action Arena to Technology

Secondly there is the channel influencing the action arena by technology. Through the shaping of technology, technology becomes the product of human action. Actors give meaning to the technology and the technology then becomes the artifact it is. Furthermore, humans constitute technology by using it by the meaning they gave to it in the process of shaping (Bijker, 1995, Orlikowski, 1992).

In this arena it stands out that closure on the meaning of technology does not always occur. The degree of closure on the meaning of technology in this arena is the same as in the agenda-setting and policy design arena, for the same reasons.

Channel from Technology to the Action Arena

The third channel moves from technology back to the action arena. Although actors have shaped the technology and made it what it is now, technology within the meaning it has been given facilitates and constraints human action in the action arena (Orlikowski, 1992).

What we can find here is that whether closure on the meaning of technology has occurred or not, the meaning given to the GIS, either by all coalitions or for each separate coalition influences the actions in the action arena. Mostly this is seen in terms of power, those who initiate the application those who have access to the data and the application gain power and behave as such. Others regard this as a threat to their own power and behave accordingly.

Channel from Technology to Structure

Finally there is the channel from technology to structure. After the actors in the action arena have shaped technology and closure on the meaning of technology occurs, meaning that a dominant perception of technology is established with which all groups can identify (Bijker, 1995) the established technology will influence the structure (Giddens, 1984). It can be said that GIS, by their functions and effects of calculation, integration, visualization, communication and transparency, and by the actions in the action arena, eventually can influence the structure. Making sure new laws are made on the basis of the outcomes and possibilities of the GIS.

Here we see that in some cases the shaping of technology did have an influence on the structure and in some cases it did not. This can be explained by whom designs the application. In the case of HIS and FLIWAS it were not those in power designing the application, which gave the designers structurally more power. In the case of contagious live stock diseases the designers excluded groups which were formerly included.

When linking this back to the case studies we can see that in the case of HIS and FLIWAS structure is being influenced. The leading opinion by water management professionals hold that HIS and FLIWAS serve as a tool of power for the water management sector. Therefore the water management sector will unite and communicate with one another. This will account for moving away from the culture of lack of communication within the water management sector. Eventually this will help account for less fragmentation of the sector.

In the case of the Riskmap there has been no influence, the design process of the GIS does not influence the structure.

In the case of contagious live stock diseases we do see an influence. Before those experts who now have no access to TSN where invited to the negotiations. Now while TSN is designed by the Friedrich Loeffler Institute they are not.

In the case of Virtuocity we see that this has not happened, the design process of the GIS does not influence the structure, only the policy design process of the urban redevelopment does.

In the case of particulate matter there has been no influence, the design process of the GIS does not influence the structure.

Finally in the case of Congestion Charging we see no influence on the structure by technology, only the policy design on the charge itself had influence, not the design of the application.

13.5.3 Conclusions

First of all it must be concluded a second arena does emerge in every single case, this arena seems to be necessary in order to design a new application. After looking at the different building blocks of the conceptual framework of policy design of this arena and at the conceptual framework of policy design a number of things must be concluded.

When starting with the separate concepts in the framework we can see that in the course of the process of policy design in designing the application a number of things can be concluded. Several variables are influenced by the use of GIS which affect the course of this process. We see that the bounds of rationality influence the course because they, contrary to the first arena of policy design, increase. This is due to the fact that the application is new, so consequences cannot be predicted. This influences the course of the process since actors revert to risk averting behavior, the course of the process therefore will be altered. For power we do see a change. Due to the use of GIS power relations shift. Those with access to the data and the application clearly gain in relative power; they decide how to design the application and often do not consult with others. It is to be seen that the initiators of the application hold the most power. Often power shifts towards experts where this power was formerly with politics, since they are mostly more able to grasp what the possibilities of the application are. This all influences the course of the process since some actors have gained power and some have lost power, and are thus less able to push their ideas forward. For conflict we see the same, the power relations which have shifted cause for conflicts in values. While designing the GIS we see that conflict is far more present than in the first arena. This can be explained by the application being new but also because actors are afraid they will loose power as soon as the application is implemented. Most conflicts deal with autonomy issues, who to share and communicate information with; fear of losing power to other actors because of the design of the application; completeness versus comprehensiveness and finally in the trustworthiness of the technology itself. When looking at the formal institutional features we see the same as in the first arena. It really matters who initiated the application. When the application was initiated by government there is less debate on how the application should look since the government simply lays the law down. When this is not the case and the government does not initiate the application formal institutional features can hinder a quick design of the application since sometimes the organizations to deal with are large in number and very fragmented. The rules in use have an impact on the course of the process as well; here we see that the rules in use account for the way the actors in the course of the process behave towards one another. It is important to see whether the rules in use are already laid down and the rule in use on with whom to negotiate. This matters to a large degree on how the application will be designed. The leading culture can often account for how GIS are perceived and communicated. A present culture dealing with risk aversion, due to the bounds in rationality; the familiarity of the issue and a culture of holding all in one's own hand matter significantly. The course of the process of policy design is adapted by this culture.

For the content of the process of policy design in designing the application the same thing can be concluded. The bounds of rationality come forward very clearly. Since the bounds of rationality have increased the content changes, since actors are afraid of the consequences of implementing the application they are reluctant to put all the possible functionalities into the GIS. Furthermore they have to balance between issues of accountability, insecurities in calculations, in- or excluding groups and costs of the technology. Therefore these bounds of rationality influence the content. For power and conflict the same goes as for the course of the process. Those who initiate the application and who will have access to the data and the application clearly gain in relative power. Since they are the initiators they have more say. Here as well it is seen that power mostly stays with those already in power. It is also seen that in all cases power shifts towards experts where this power was formerly with politics. The formal institutional features have the same effect as they had in the course of the process. When the government initiated the application the application is embedded by law and with institutions, giving those with access the legal power to decide over content. This goes for the rules in use as well. For culture the same can be said as before, the leading culture will affect the content of the process of policy design since risk aversion and the familiarity with an issue will have a large effect on what the content will be.

Finally for the outcome of the process of policy design in designing the application these variables also matter. The increase in the bounds of rationality due the inability to predict consequences of implementation makes sure not all functionalities are placed in the application. Its potential is not used fully. Additionally accountability issues, insecurities in calculations, in- or excluding groups and costs of the technology have to be taken into account. Therefore a satisficing solution is in each case found. For power the same goes as for the course and the content. While some actors have gained power over others they will be able to see more of their ideas back in the final outcome. The formal institutional features and the rules in use enforce this. When the application and the laws making it possible are institutionally embedded these actors gain even more power which makes sure they can push their ideas forward more fiercely. Culture finally also impacts the outcome; this because the leading culture will partially determine which alternative is acceptable in terms of risk aversion and distrust.

When looking at the conceptual model of policy design we have seen that in all cases the actors in the action arena push their values and ideas forward while using their technological frame, within the bounds of their rationality. We can conclude a number of things here for the influence of GIS on the course, content and outcome of the process of policy design of designing the application.

Firstly it is very important for the course, the content and the outcome, who initiated the application; this is seen within the action arena. Those who initiated the application have more say than others and have a clear advantage in deciding how the application should look. Those who have not initiated the application often fear the application once implemented will derive them of power. As shown in the other arena, this is indeed often the case. The initiators therefore have a clear advantage in pushing their issue forward towards policy design. In terms of the course of the process they gain power while others do not or loose power. In terms of the content of the issue they have the information on what they want to do with the application so they have greater power in defining the content. In terms of outcome they have far more chance for their ideas to reach agenda status.

Secondly we see that the structure influences the actions within the action arena. It is very important who initiated the design of the GIS. The initiator benefits since the application serves the initiators interests. When the government initiates the design of the application the application is institutionally embedded, making sure there is little possible in the action arena. When everything is laid down by law other actors cannot influence the application very much any more. This thus reinforces the rise in power those actors already had obtained by being the initiator. When the government does not initiate the application nothing is bound by law yet. This makes sure the initiators do not have this extra power. This is important in terms of course of the process of policy design because it will grant some more power than others, this goes for the content as well as for the outcome. Furthermore the rules in use influence policy design as well. The rules in use account for the way actors perceive GIS. Finally culture does the same, a culture of risk aversion and familiarity with the issue influences the course, the content and the outcome of the process of policy design.

Thirdly it is important to look at closure on the meaning of technology, sometimes it occurs and sometimes it does not. In this arena the same patterns of closure on the meaning of technology are to be found as before. The occurrence of closure on the meaning of technology can be explained by a number of factors. Firstly it can be explained by the scope of the application. An application with a lot of different functionalities will reach closure on the meaning of technology far less quickly than an application with little functionalities, this simply because the application is easier to grasp. Secondly the subject itself is important; a highly politicized subject will less likely reach closure on the meaning of technology than a subject which deals with little political values. Thirdly it is important who has access to the data and the application. As the particulate matter case shows when more than one actor has access to the data it becomes impossible for one actor to use the application over another actor. And finally the goal of the application is important. An application demanding for action will far less quickly see closure on the meaning of technology than an application which does not. Even though closure on the meaning of technology is important in having all actors viewing the technology the same way, it does not influence the process of policy design.

Fourthly and linked to the third point is that it is very important for the process of policy design how the GIS, whether closure on the meaning of technology has occurred or not, is perceived by the actors in the action arena. Mostly this is seen in terms of power. Those who initiate the application and who have access to the data and the application gain power and behave as such. Others regard this as a threat to their own power and behave accordingly

A final conclusion can be drawn on the point whether GIS once shaped can influence structure. In this arena this happens less than in the first arena. This can be explained by the fact that the technology is not implemented yet. The only changes in structure are found when the government has laid down the law beforehand.

Chapter 14

Conclusions

14.1 INTRODUCTION

This research started with looking at what GIS are by looking at existing literature. Theories of agenda-setting and policy design were looked at, a position in the technology debate was chosen and two conceptual frameworks were made. Six case studies have been conducted; they have been analyzed and compared according to the lines of the conceptual framework.

Now is the time to look at the very first chapter, go back to the main question and formulate an answer based on the conducted research.

In the first chapter it was stated that the goal of this research is twofold. A first goal is to establish how the perception and use of GIS influence processes of agenda-setting, in terms of the course of the process, the content and the outcome. A second goal is to establish this in terms of policy design. The main research question therefore was stated as follows:

> *How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?*

In this chapter first the sub-questions as posed in chapter 2 will be briefly answered. This will mostly be a summary of what is said in the specific chapters to which the questions refer. Secondly the main question will be looked at and conclusions, and thus answers, to this main question will be given. Finally some reflections will be made on GIS, the research design and on the influence of GIS on policy design and agenda-setting.

14.2 ANSWERING THE SUB-QUESTIONS

In the first chapter five sub-questions were posed which needed to be answered before the main question can be addressed. Now in the concluding chapter first these questions will be briefly addressed.

The first question dealt with what GIS entail, what they are and what qualities and effects are attributed to them. The question sounded:

> *What are Geographical Information Systems, which qualities are attributed to them, and how and in which fields are they used?*

In the second chapter as well as in the chapters on the case studies it can be found that GIS are integrated systems which are able to manage large amounts of data linked to a geographical location. Furthermore, as examples in literature demonstrate and as we have seen in the case studies, GIS are not only used in fields of traditional earth sciences but are also used in other fields of policy. This demonstrates the geographical location is still very important and that GIS are becoming a common tool in public policy-making.

Several qualities are attributed to GIS, this was, in the second chapter, shown by a literature review but in the case studies the empirical reality of these qualities were elaborated on. We saw GIS could account for standardization within and between organizations, but only if the GIS application was designed to do so. Secondly integration of different datasets became possible and new information could be generated. Again, only if the GIS application was designed with the goal to do so. GIS were also said to have the quality of calculation. In the case studies it showed that, provided a calculation module was present within the application, this quality is indeed present. GIS can make different calculations using large quantities of data, making sure situations can be sketched and effects can be calculated. It must be said however these calculations can hold large margins of error and are often not trusted by the receivers of these outcomes. Furthermore it has become clear visualization is a core quality of GIS. Very complex data can be made visible in a map, movie or picture. A lot of people, even those without expertise in the specific policy field, can understand with the use of GIS what consequences of certain policies are.

GIS are also said to have some effects, this can be found in the literature review in chapter 2 as well as in the empirical chapters. The first of these effects was an increase and improvement of communication. It has been demonstrated in the case studies that indeed communication has improved, not only between experts and policy-makers but also between experts, policy-makers and the public. This improvement can be attributed to the visualization function of GIS. By making plans understandable communication improved. A second effect GIS are said to have is increased transparency. The empirical reality of this is rather ambiguous. Transparency of the policy issue at stake indeed does increase due to the calculation, integration and visualization function of GIS, but can decrease when the calculations are not trusted. The same goes for the transparency of the policy problem, transparency does increase because the problem can be looked at from different angles but when calculations are not trusted a decrease can be found. The transparency of the work process has increased as well, provided that the GIS application was designed with a function to standardize. Finally the transparency of the consequences of the GIS application itself has decreased since the GIS applications researched are new in their kind.

After looking at what GIS are and what their effects could be the second sub-question dealt with epistemology and sounded:

What is the epistemological position that fits the analysis of Geographical Information Systems and their influence on agenda-setting and policy design best, and what does this position mean for the research?

In chapter 3 the technology debate was dealt with, it was concluded the best position for researching the influence of the perception actors have on GIS would be the position of social construction of technology. This means that GIS has been looked at by assuming people make GIS what it is. The consequences and effects the implementation of GIS are not predetermined, humans hold agency. The reason for the choice for this position can be found in the fact that the main question of this research demanded for an approach in which perception is not only emphasized but can also be explained according the same lines of the approach. Secondly social construction of technology is able to account for the dynamics of the interactions in the processes of agenda-setting and policy design. Furthermore, empirical evidence found in research from other scholars suggested social construction of technology would be the most fitting position to use.

For the research this meant not only the position of social construction of technology would be used but also social constructivism in general. Reality would be seen as shaped by humans and perception would be taken in.

After conducting the case studies it can be concluded that in the light of the main question social constructivism and social construction of technology were very appropriate to use when looking at the reality of GIS in agenda-setting and policy design. The choice for this position enabled the possibility to look at perception and power relations in a way other positions would not have allowed.

The third sub-question dealt with the theory of both agenda-setting and policy design; here the theoretical framework of both processes was addressed.

What is agenda-setting and policy design, what do existing theories on both processes entail and how can these existing theories help to research the influence of the perception and use of Geographical Information Systems on these processes?

In chapters 4 and 5 it was explained what agenda-setting and policy design as processes entail. Agenda-setting was seen as the process of getting a subject or a problem to gain attention from government or those closely related to government. Policy design was defined as the process of defining, considering and accepting or rejecting options for political decision.

A number of existing theories on agenda-setting and policy design were looked at. The selection of these theories was based on which theories could be useful in answering the main question. The basis of this claim was made by looking at existing literature on GIS.

For agenda-setting firstly the barrier model was discussed. In this model it is assumed that an issue must pass two barriers in order to obtain agenda status. This is firstly the barrier of fitting dominant values in society and secondly the barrier of institutional procedures (Bachrach & Baratz, 1970). Secondly the Cobb and Elder model has been looked at. Here it is assumed for an issue to reach agenda-status it must be expanded to a larger public. Whether this happens is dependent on the nature of an issue in contrast to the content (Cobb & Elder, 1972). A third theory on which we elaborated was the stream model. The idea of the stage heuristics is dropped and problems and solutions float around until they find each other. When they do so together with a positive political climate and the opening of a policy window the issue could reach agenda status (Kingdon, 1995). Finally the advocacy coalition framework has been explained. Here also the stage heuristic is left behind and it is assumed that several advocacy coalitions negotiate on the content of the issue but also on getting it on the agenda (Sabatier, 1993).

For policy design the first theory discussed was the satisficing model; here humans cannot display the degree of rationality assumed by the rational actor model. Humans are bound in the degree of rationality they can display and therefore, together with the fact that time and resources are often lacking, actors opt for a sub-optimal solution that fits the criteria of being satisfactory (Simon, 1957; 1976; March, 1994). A second theory which was elaborated on was successive limited comparisons, or incrementalism, here as well it is assumed that humans are limited in the degree of rationality. Furthermore it is believed that actors should choose those alternatives that do not differ severely from the present situation, making sure they do not opt for radical change which can have unforeseen consequences (Lindblom, 1957). Thirdly mixed scanning was explained, this is a mix between the rational actor model and successive limited comparisons, and prescribes to first scan all possible alternatives very generally and then look in detail at the alternatives which look viable in the scan (Etzioni, 1967). The normative optimum model is also a reaction to the rational actor model and successive limited comparisons. In this model the bounds of rationality are acknowledged but extra rational components are added (Dror, 1968). Finally the institutional analysis and development framework was looked at. In this framework actors negotiate on a proposal in the action arena and their actions are constrained or enhanced by culture, rules in use and attributes of the physical world (Ostrom et al., 1994).

When looking at how these existing theories can help to research the influence of the perception of GIS on agenda-setting and policy design, several concepts and variables were taken out of these existing theories which are be used to build a conceptual framework in chapter 6. Those concepts were taken out which, in existing literature, proved to be of use in researching this question. For agenda-setting these concepts were mobilization of bias, conflict of values, power, formal institutional features, the nature of the issue and the policy window. For policy design the concepts used were bounded rationality, satisficing, conflict of values, power, formal institutional features, rules in use and culture.

After looking at the existing theories of agenda-setting and policy design it was important to build a conceptual framework of how to look at these processes in this research. The sub-question relating to this sounded:

> *In which way is it to be expected that processes of agenda-setting and policy design proceed when dealing with Geographical Information Systems?*

In answering this question in chapter 6 a conceptual framework was built for agenda-setting and for policy design. The core of the conceptual framework of agenda-setting can be summarized by starting with the policy sub-system, in which interaction is influenced by formal institutions, the nature of the issue and the policy window. The policy sub-system is also influenced by technology which, after it is shaped by the actors, constraints and facilitates the actions in the policy sub-system through the technological frames the different groups of actors have. Once established, the technology will influence the structure. In the policy sub-system several groups try to push their values, which could conflict with values held by other groups, forward in order to come towards a situation in which their preferred issue reaches agenda status. They do so within their technological frame and with their relative power. Finally agreement will be reached and one alternative will be chosen as the alternative that will constitute for the issue which reached agenda status.

The conceptual framework of policy design operates for a large part in the same way. This means there is an action arena, in which interaction is influenced by formal institutions, rules in use and culture. The action arena is also influenced by technology which, after it is shaped by the actors, constraints and facilitates the actions in the action arena through the technological frames the different groups of actors have. The technology will influence the structure. In the action arena several groups try to push their values, which could conflict with values held by other groups, forward in order to come towards a policy design matching their values. They do so within their technological frame and with their relative power. All actors are limited in the degree of rationality they can demonstrate. They will aim for a satisficing solution; firstly because time and resources are scarce, secondly because they know consensus has to be made. Finally agreement will be reached and one alternative will be chosen as the alternative that will constitute for the policy design.

This is then how the case studies were looked at and these were the lines according to which the case studies were analyzed.

The final sub-question dealt with the empirical reality. This question was posed as follows:

> *What is the actual influence of the perception and use of Geographical Information Systems on processes of agenda-setting and policy design in terms of course, content and outcome of these processes?*

This final sub-question was answered by conducting six case studies, all six in different areas of public policy and on different territorial scales. The first case dealt with HIS and FLIWAS, a GIS application which is used to monitor water levels in the Netherlands and Germany. The application is also used to predict floods and the consequences of these floods in terms of economical damage, evacuation and victims. The second case which was researched was the case of The Riskmap. This is a GIS application used by the Dutch government to inform citizens on internal risks in their neighborhood. These risks include storage of dangerous substances and industries potentially damaging. The third case which was researched in the field of agenda-setting was the case of TSN. Here a GIS application is used by the German government to obtain insight in contagious live stock diseases. The application can calculate consequences of an outbreak and will calculate effects of measures for prevention and containment. The first case dealing with policy design was Virtuocity in two cities. This is a GIS application used by the Dutch municipalities of Tilburg and Helmond. This application views building plans for the urban centers in a three dimensional way so citizens can view their city, comment on the plans, and in some cases vote for several alternatives. The fifth case dealt with particulate matter. In this issue a GIS application is used by the Dutch government to measure concentrations of particulate matter in real time or as consequence of a potential building plan. On the basis of this application building plans can be stopped. The final case researched was Congestion Charging. Here a GIS application is used in London. The application is able to monitor congestion but is also able to calculate consequences of measures to reduce congestion.

Since this sub-question relates to the main question to such a large degree the answer for this sub-question will be given in the next section together with the conclusions on the main question.

14.3 THE INFLUENCE OF GEOGRAPHICAL INFORMATION SYSTEMS

In the course of this research the sub-questions have been answered, the empirical research has been described and analyzed and compared. Now it is time to look at the main question posed in chapter 1, and draw some conclusions on the influence of the perception of GIS on agenda-setting and policy design. The main question as posed sounds:

> *How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?*

Since the main question is fairly wide in scope below the conclusions will be sub divided into first the influence of the perception and use of GIS on agenda-setting, secondly on policy design and finally on designing the application itself. Since the conclusions in detail have been discussed in the chapters on the cases as well as in the comparison, here only those conclusions will be elaborated on which are the most relevant in explaining the influence of the perception and use of GIS.

14.3.1 The Influence of Geographical Information Systems on Agenda-Setting

When starting of with how the perception and use of GIS by different actors influence the course, content and outcome of processes of agenda-setting, five main conclusions must be drawn.

First it is important to look at closure, the alignment of all technological frames. In other words, do all actors perceive the technology the same way. The question is: does it occur or not and why. Empirical evidence shows us whether closure on the meaning of the application occurs is dependent on the goal of that application itself. An application which demands action achieves closure on the meaning of technology less quickly than an application which is only used for communication. For example, for the Riskmap closure on the meaning of the Riskmap was fairly easily achieved since the goal was communication. For HIS and FLIWAS closure on what the two applications meant was more difficult to achieve because the application demanded action to be undertaken, dikes needed to be reinforced and building projects had to stop. Furthermore an application with a large scope and a large number of functionalities will reach closure far less likely than a simpler application. In the case of TSN for example it becomes clear that it is difficult to establish whether TSN is a tool for calculation, communication, integration or visualization. The Riskmap only held one function, namely communication and closure on the meaning of the Riskmap was therefore easier to establish. The issue itself is important too, a highly politicized issue does not help closure to occur. The presence or absence of closure on the meaning of the technology does influence the process of agenda-setting.

The second main conclusion deals with power, when using GIS in issues of agenda-setting empirical reality shows power relations between involved actors can change dramatically. Actors without power can become empowered and actors who were in power can lose this power. This can be explained by the idea that by using GIS new information becomes visible through the functions of integration, calculation and visualization. Those who have access to this information gain in power significantly over those who do not. It is not only the data which gives them this power but also the application. The raw data alone is not enough for this shift in power but it is the application that allows the calculations, the simulations and the scenario sketching which enforces this power. Since GIS is an application which can do so it can be stated that the 'war on data' as it was called decades ago is not applicable anymore since the application itself is important to a far larger degree. This shift in power can be seen mostly in a shift of power to experts and technicians; they with the use of GIS can communicate their ideas to policy-makers and the public in an understandable way and can visualize consequences of alternatives. In the case of HIS and FLIWAS, with the interactive movies it shows the often difficult issue of water management can now be communicated to governments and citizens in an understandable way. Furthermore, through standardization organizations can integrate making them a powerful block. Also the public could gain in power when the GIS application was designed to inform them. It must be kept in mind the gain in power is a perception of the actors involved, whether closure on the meaning of the technology has occurred or not. Those who are perceived to have more power will act as such and will eventually gain this power. This means a number of things. Firstly for the course of the process of agenda-setting it means those who perceive themselves empowered by GIS will tend to take a

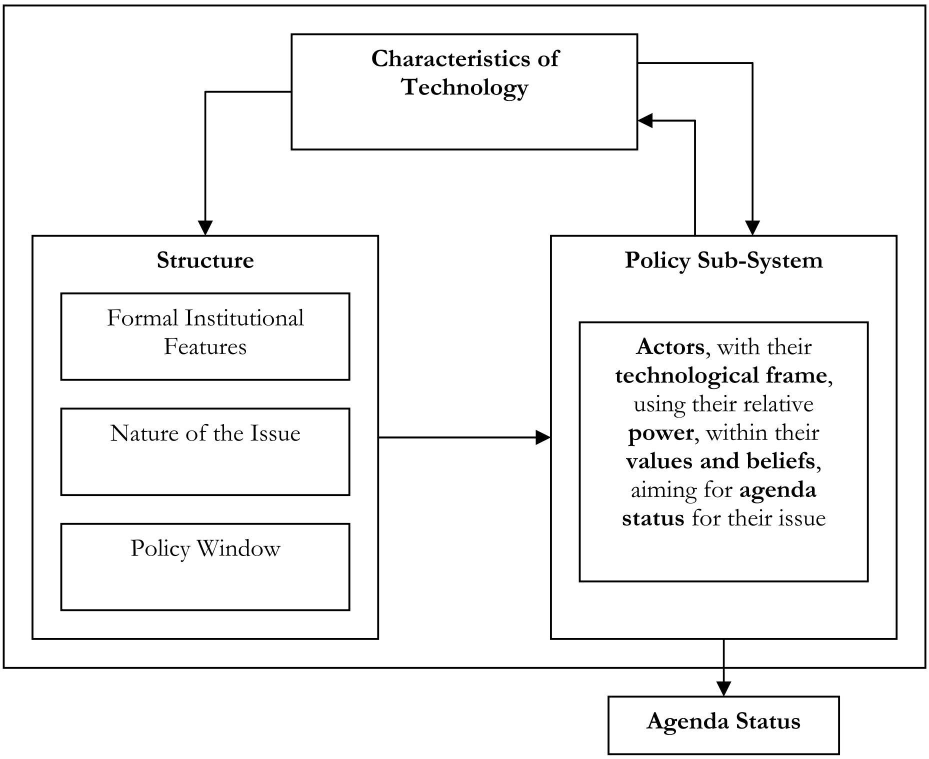

Figure 14.1: The Conceptual Framework of Agenda-Setting

leading role in the course. Those who do not feel empowered by GIS but do acknowledge others are empowered will give those empowered actors more room to push their ideas forward. In terms of mobilization of bias the core of this concept comes forward, some interests are organized in and some are organized out. This means that those with access to the GIS application are able to influence the course of the process to their liking for a large degree. The case of TSN has demonstrated this very clearly. Here experts with opinions different from other experts were successfully organized out of the application. Their ideas therefore were organized out as well. For the content of the process of agenda-setting something similar happens, those who feel empowered by the GIS application have far more influence on the content of the process, they decide which ideas will be pushed forward and how they will be pushed forward. This can be found in the outcome of the process in which those ideas mostly gain agenda-status which were initiated by those who felt empowered by the use of GIS. They have access to the data and the application and have the power to communicate this information in a way others understand. The case of HIS and FLIWAS demonstrates these applications helped the water management sector to push their views on water management and flood prevention forward.

A third conclusion which must be drawn relates to the second conclusion, even though power relations are significantly altered by the perception of GIS, some are empowered and others are not, this is not a random process. Empirical data shows us that it depends on the initiator of the GIS application who is empowered by this application. When the GIS application is initiated by the government, it will mostly empower the government and will help push forward their ideas. However, when this is not the case and the GIS application is initiated by another actor, the ideas of this actor will be helped by GIS. The power they gain seems to be less however than the power the government gains when they initiate the application. This can be explained by the fact that when the government initiates the application all is laid down by formal laws and regulations, making discussion impossible, other actors do not have this power. Mostly this corresponds with the reinforcement thesis which claims that those in power benefit by ICT systems while they decide the purpose and use of the application (Kraemer & King, 1986). This means for the course of the process of agenda-setting that indeed GIS can alter the course, due to the existence of a GIS application the initiator of the application gains power, making sure this actor dominates in the policy-subsystem since often other actors acknowledge this power. In the content of the process the initiator has the power to push his ideas forward over other ideas which naturally comes forward in the outcome. The issues of the initiator of the application are more likely to reach agenda status then ideas brought up by others. This is even reinforced when the initiator is the government. The cases of TSN and the Riskmap demonstrate this clearly. The government wanted both applications to be implemented and they decided on the content of the application and who to grant access. In the case of HIS and FLIWAS it becomes clear the water management sector has initiated the applications and therefore they decided what to include in the application, giving them the monopoly on the data and the application. Therefore they gained the power to push their ideas forward.

The fourth conclusion which must be drawn does not deal with power but with the GIS application itself. Where agenda-setting deals with pushing forward new ideas, new problems and new views with the goal to gain them agenda status GIS can offer an opportunity to do so. In each case study researched the GIS application itself caused the opening of a policy window. GIS accounts for integration of different datasets, the calculations and the outcomes deriving from this. Furthermore the visualization function of GIS allows actors to make sure a large group of people understand their ideas. Because of this new issues can be found, new problems arise and new possibilities emerge, these possibilities are not only seen by experts using GIS but also by policy-makers and in some cases the public. This accounts for the opening of a policy window. Therefore because of the implementation of a GIS application a policy window opens through which new ideas can be pushed forward which were generated by the GIS application itself. For the process of agenda-setting this means firstly that because of the opening of the policy window all actors have a chance to push their ideas forward, not only those empowered by GIS but also other actors. They have an opportunity to voice their views and aim for agenda status for their issue. The course and the content of the process of agenda-setting are in this way altered. For the outcome of the process of agenda-setting this new perceived opportunity means that issues have a larger chance of gaining agenda-status, while the policy window is open it is easier for actors to place their issues on the agenda. When for example looking at the case of the Riskmap it becomes clear that with the new overview on internal risks a policy window has opened. Issues on where to store substances and where to locate homes can be pushed forward by the newly gathered information.

Finally for the influence of the perception and use of GIS on agenda-setting it must be mentioned that after the GIS application has been implemented and used , the application as well as the actions which were undertaken influence the structure. This influencing of the structure will have an effect on agenda-setting. Once power relations are institutionally embedded and laws are made, the policy sub-system will react to this and the new power relations and the new laws will influence the process of agenda-setting, mostly in terms of power. This comes forward in the case of HIS and FLIWAS and the Riskmap. Here water management professionals and first aid agencies are structurally invited to the negotiation table on spatial planning, where before the use of GIS they were not.

14.3.2 The Influence of Geographical Information Systems on Policy Design

After looking at the influence the perception and use of GIS have on agenda-setting the same must be done for policy design. Some of these conclusions are similar to those of agenda-setting.

Like for agenda-setting a first conclusion must be drawn on closure on the meaning of the technology, sometimes it occurs and sometimes it does not. As for agenda-setting this depends on the scope of the application, the goal of the application and the degree of politicization of the issue. But there is another factor which comes forward, namely who has access to the data and the application. When there is only one actor with access to both this actor can use this application to push his idea forward. When a number of actors have access this is not possible anymore and no single actor can use the GIS application to push his ideas over others. Giving a large number of different actors access to the application could therefore increase the likelihood of closure on the meaning of the technology. In empirical evidence this is not found in the field of agenda-setting but this does not mean the point is invalid there. Theoretically granting more actors access over the application should increase the likelihood of closure in processes of policy design as well as agenda-setting. When comparing the case of particulate matter to other cases this comes forward. In the case of particulate matter a number of actors have access to the application and the data and they all use it in the same way, because of this they agreed on the meaning of the application. In other cases only the initiator of the application had access to the application which accounted for other actors having a different view on what the application means.

A second conclusion is, similar to agenda-setting, that power relations are dramatically altered by the use of GIS in policy design. Actors who had power might lose this power and actors who priorly had no power might now be empowered. Those with access to both the application as well as the data gain in power. They are the ones deciding which calculations to make and what information to show and share. They perceive the GIS application as empowering and they will act as such. Those who perceive the GIS application as threatening will behave accordingly. For the process of policy design this means the same as for agenda-setting. Those with access are more able than others to see more of their ideas back in the final policy design, the course is influenced since they dominate the policy design arena. The content is influenced because they are more capable of pushing their ideas forward and finally the outcome is affected since they will see more of their values back in the final design. This can all be brought back to the functions of integration, calculation and visualization GIS holds for the same reasons as stated above in the section on agenda-setting. The Congestion Charging case is one of the best examples for this. With Transport for London as the sole user of the application they are the ones with the power to calculate, communicate and decide. All other actors are left merely powerless.

The third conclusion corresponds with one of the conclusions in the agenda-setting arena as well. Here in the policy design arena it is important who initiated the implementation of the GIS application. The actor initiating the application will make sure the application serves his goals. Again, if this actor is the government they will be even further reinforced since they are able to ground the application in formal laws making alterations to the application or discussion impossible. This corresponds with the reinforcement thesis, which claims ICTs will only enforce those in power (Kraemer & King, 1986). This affects the course, the content and the outcome of the process of policy design because the initiator has more power to push ideas forward and will see more of his ideas back in the final design. In the case of Virtuocity in Tilburg it can be found that citizens accused the local government of trying to fool them into thinking they were empowered while in fact the government still decided on what citizens were allowed to decide and which alternatives they could choose from.

Next to conclusions which correspond with the conclusions drawn for agenda-setting, some policy design specific conclusions must be drawn. It must be noted that by the use of GIS bounds in rationality decrease. Because GIS can calculate large quantities of data and present this data in a way a lot of people understand, and because simulations can be made and effects can be viewed it becomes possible to design policy in a more rational way. This means for the course of the process of policy design that actors are more able to communicate with each other, through integration and visualization functions of GIS. The content of the course of policy design as well as the outcome are severely affected by this decrease in the bounds of rationality. Due to increased transparency, the calculations, the simulations and the new information which can be made the content as well as the outcome of the policy design process changes. New issues may arise and new possibilities can emerge and can be looked at as serious alternatives. The outcome of the process than becomes not only more rationally based but can also be backed by simulations and improved calculations. In the case of Congestion Charging it can be found that by the use of GIS the effects of the charging zone could now be simulated so it could be found which zone would have the maximum effect. This made sure policy-makers were far more aware of the consequences of placing the zone at a certain location.

Another conclusion than can be drawn on the influence of the perception and use of GIS can have on processes of policy design is that culture and the rules in use affect policy design. The use of GIS can interfere with existing rules in use and culture. First of all we see a rule in use as well as a culture of trusting nominal numbers. While calculations in GIS are based on nominal numbers it would seem a GIS application would be trustworthy, this is not always the case. Due to large margins of errors and insecurities in these numbers and formulas the outcome of a calculation can be perceived as illegitimate and as a way for actors to push their ideas forward. This shows us the calculations GIS make do not always account for a more rational final design but can also cause serious conflict. For the process of policy design this means conflict is opened on the trustworthiness of the application and its functionalities, the course of the process is influenced since the debate will deal with whom has the correct numbers and what these numbers actually entail. The course of the process and the outcome do not seem to be severely influenced since the leading culture will make sure nominal numbers will be trusted in the end regardless of the discus-

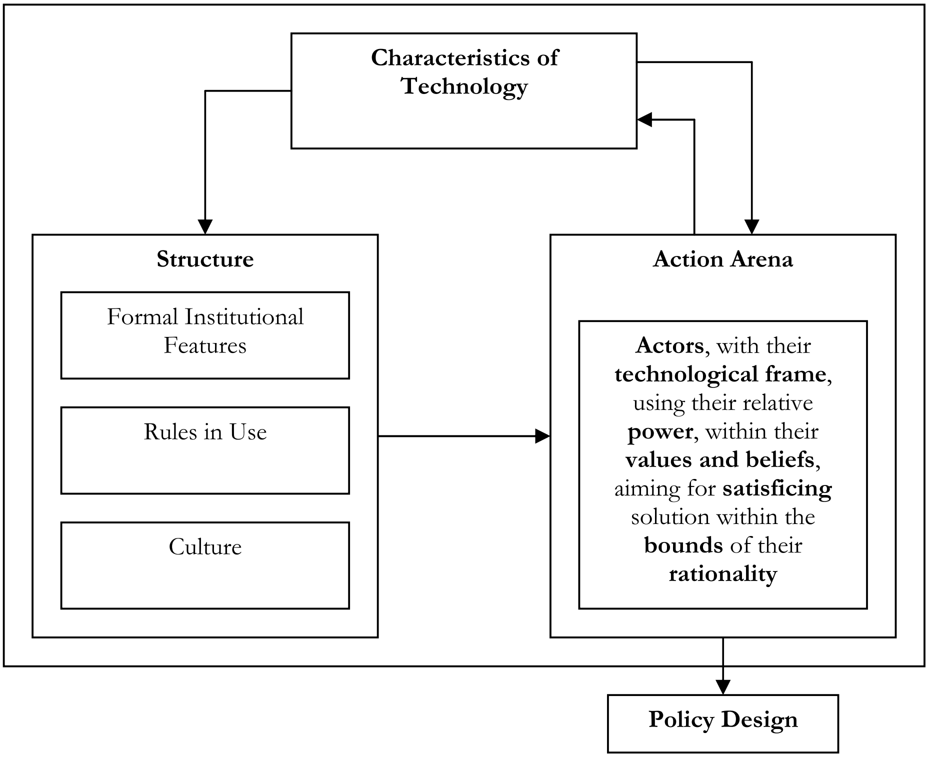

Figure 14.2: The Conceptual Framework of Policy Design

sion on their legitimacy. The case of particulate matter demonstrates that conflicts on the outcome of the calculations GIS can make can be a serious problem. The outcome of the calculations, on which decisions on spatial planning are based, are by no means without error. Margins of insecurity were large and the formulas might be incorrect. For all actors this accounted for debating and distrusting the outcomes of calculations in this case.

Finally, as for agenda-setting it must be said that once GIS is implemented and used it influences structure. This influencing of the structure will have a strong effect on the course, the content and the outcome of the process of policy design. Once power relations are institutionally embedded and laws are made, the action arena will react to this and the new power relations and the new laws will influence the process of agenda-setting, mostly in terms of power. For particulate matter it shows now environmental organizations also have access to the data and the application they are a force to be reckoned with, they can go to court and stop building plans.

14.3.3 Designing the Geographical Information System

In every single case study it was demonstrated that next to the arena in which agenda-setting took place or policy was designed on certain policy issues another arena had occurred. This is the arena in which the GIS application was designed. In this section some conclusions on this arena will be drawn.

First and foremost, the fact that this arena emerges simultaneously with the arena on a specific policy issue is a conclusion. Therefore it can be claimed when implementing technology and specifically complex and multi-functionality applications like GIS, another arena emerges in which policy needs to be designed on how to design the application. In some situations the actions in the first arena (agenda-setting and policy design) occur simultaneously with the actions in the second arena on designing the application. Sometimes the designing of the second arena partly precedes the arena of agenda-setting and policy design. It is important to understand that in the second arena, the arena of designing the GIS application, a large deal of the ground is covered on which closure on the meaning of the technology can or cannot occur. As concluded in the two sections above, the initiator of the application, who has access to the data and the application, the scope and the goal of the application determine for a large part whether closure on the meaning of technology occurs. Also power relations in agenda-setting and policy design processes determine this. It is this arena in which these matters are determined. Therefore in order to understand processes of policy design and agenda-setting when dealing with GIS the arena in which the GIS is designed must be understood, acknowledged and dealt with.

When looking inside this arena a number of conclusions can be found. As for the two other arenas it is important to look at closure on the meaning of the technology, sometimes it occurs and sometimes it does not, the reasons for this are the same as in the other two arenas. What is important here is that the reasons, the scope and functionality of the application as well as who has access to the application, are determined in this arena. The outcomes in the policy design process of GIS influence the arenas of agenda-setting and policy design on policy issues later. When closure on the meaning of technology occurs in this arena it is more likely that closure on the meaning of technology will also occur in other arenas in which the application is used.

A second conclusion is also the same as in the two arenas described above. Namely that in this arena, even though this is the arena in which GIS are designed, power relations alter dramatically when dealing with GIS. Those who will have access to the data and the application gain in power, their perception of their gained power will make sure they behave accordingly; they perceive the GIS application at stake as empowering them over others. Here it is found the initiators of the application mostly decide who has access to the application and mostly grant themselves access. Therefore they benefit in two ways, they are the ones with access and they determine the goal of the application since they are the initiator, making sure the application serves their purpose. This all influences the course of the process because some actors have gained power and some have lost power, and are thus less able to push their ideas forward. For the course as well as the content and the outcome of the process it is important to note here that a large amount of power is gained by experts, since they are mostly the ones with access to the application. However, this seems the same as in the other two arenas but it must be noted that in the arena of designing the GIS application far more conflict can be found. Because in this arena it is not clear yet who will be granted access and for what purposes the GIS application will be used there is more room for conflict, all actors would like GIS to empower them. This is shown in the case of TSN in which the experts without access tried, in this arena, to still gain access. Without access they knew they would have no way of pushing their issue forward.

The third conclusion in this arena is also similar to the conclusions drawn in the other two arenas, namely that the initiator of the application holds a lot of power since the initiator is able to decide how the application is going to look. What is different in this arena is that when the government initiates the application it is indeed reinforced because it can lay the ground rules of the application down by law. However, if it is not the government who initiates the application in this arena the initiator might be seriously hindered by formal institutional features, mainly because organizations can be much fragmentized. This influences the course, content and outcome as described above in the other arenas. The case of HIS and FLIWAS shows this, while the water management sector is very fragmentized and the water management professionals had no power of adapting the institutional setting to their wishes they had a difficult time in designing the application but also later in pushing issues forward.

Fourthly the bounds of rationality must be looked at. In the previously discussed arena the bounds of rationality were lifted by the use of GIS, in this arena they increase. The reason for this is that in this arena there are no calculations or simulations to be made and there is nothing to visualize. In this arena actors deal with a new application which is often not even completely developed, what the consequences of this application will be, economically, socially and politically, is completely unclear since there is no precedent. What this means for policy design in this arena is the whole process is characterized by a mood of risk aversion, some functionalities of GIS are not implemented, some actors will not be granted access, the scope of the application is shortened and so further. The content of the process is also altered because actors are afraid of the consequences of implementing the application they are reluctant to put all the possible functionalities into the GIS application. Furthermore they have to balance between issues of accountability, insecurities in calculations, in- or excluding groups and costs of the technology. Therefore these bounds of rationality influence the content as well as the outcome severely. The case of Virtuocity demonstrates this mood of risk aversion. Both local governments were unaware of what the consequences of implementing Virtuocity were; therefore they decided not to implement the application to its full potential.

As a fifth conclusion it must be noted where satisficing as a concept was not very clearly present in the arena on policy fields in this arena it is. Because of the risk averting behavior, because integration cannot always be established due to autonomy issues, because communicating all information cannot always be achieved, because the balance between complete information and still remaining understandable without being overloaded and because time and money are pressing. The content and the outcome of the process is therefore often sub-optimal. The case of Congestion Charging shows that CCTV was chosen while Transport for London knew the application was inaccurate. There was simply no time to test other applications. Also the Riskmap shows that placing all instances of internal risks on the map would be difficult. The viewer would be overloaded with information and the overview would become so difficult to understand that the goal of the Riskmap would be compromised.

Another conclusion can be drawn on culture, the leading culture often accounts for how GIS applications are perceived and communicated. Next to a culture of risk aversion as described above there is also a culture of the government keeping all decisions in its own hands. In this way limiting conflict in this arena but also making sure they hold power, since the initiator, especially when this is the government, holds most power. Several cases show that the government had made sure there could be no debate on what the application should entail, all was institutionally laid down already. These are the cases of the Riskmap, TSN and Congestion Charging.

Finally we can conclude on whether the application once implemented, partially or complete influences the structure. This does not happen very often in this arena, which can be explained by the fact that mostly in this arena the technology is not implemented to a degree in which this is possible.

14.3.4 The Arenas Compared

When looking at the conclusions drawn for each arena some striking similarities can be found but also some differences. It is important to understand both the similarities and differences in order to come to a general insight on the influence of the perception and use of GIS in agenda-setting and policy design.

Starting of with the similarities it becomes clear that in all three arenas it matters whether closure on the meaning of technology has occurred or not, this influences the course, the content and the outcome of the processes as described above. The occurrence of closure on the meaning of the technology in all three arenas is dependent on the application, its goal and its scope as well as on the issue itself, a highly politicized issue is less likely to achieve closure.

A second similarity in all three the arenas is that power relations are dramatically altered by the use of GIS. The qualities and effects of GIS give some actors power over others. This can be found in terms of access to the data and the application. Those with access to the data and the application gain in power over those who do not, some groups of actors are even organized out of the issue entirely as seen in the case of TSN. Furthermore a clear shift in power towards experts and technicians can be found, they now have the power which was formerly held by local or national governments.

A third similarity in the conclusions drawn in the three arenas is the conclusion regarding the initiator of the application. In all three arenas it is so that the initiator of the application holds more power than the other actors. This can be explained by the fact that the initiator decides on the goal of the functionality and can make decisions on whom to grant access. When the initiator is the government this is even further reinforced since the government is able to deal with matters of access and the goals of the application by law, making sure no other actors can co-decide.

Finally it is to be seen that in all three arenas eventually the structure is influenced. Power relations after they have shifted become embedded in the structure leading the way for future issues of agenda-setting and policy design.

Next to the similarities found in the three arenas there are some conclusions which were arena specific, such as the conclusions on the policy window and a culture of trusting hard nominal numbers. But there are also some striking differences between the three arenas.

A first difference can be found in the degree of conflict, in the agenda-setting and policy design arena there is far less conflict than in the arena of designing the GIS application. This can be explained by the way actors anticipate power. The arena in which the GIS application is designed sets out future power relations, here it is decided who has access to the data and the application and who has not. Also here it is decided who will be invited to the negotiation table when the policy on the issue itself is designed. Actors in this arena will come into conflict with one another more easily because here they can establish their role. These power relations in the agenda-setting and policy design arena are already established. This means that actors in the arena of designing the application are willing to try to gain access and influence over the application so in the future they will be able to hold a better power position when policy on issues is designed. This is also the reason why in the arena of designing the application governments tend to hold all matters in their own hands.

A second difference which can be found is found in the bounds of rationality. In the policy design arena the bounds of rationality decrease, because of simulations, improved communication, increased transparency and newly generated information the bounds of rationality on policy issues become less. In the arena in which the application is designed however, the bounds of rationality increase. This can be explained by insecurities on consequences of the application; since the application is newly designed actors are not aware of the consequences of implementing the application. The difference can be explained by looking at the subject of the arena itself, the consequences of implementing are not an issue in the policy design arena. The calculations on any given subject are not an issue in the arena of designing the application. It must be noted however that because of the increase in the bounds of rationality in the arena on designing the application there occurs more satisficing. Because actors are unaware of consequences they often choose for a satisfactory solution while holding a culture of risk aversion.

14.4 REFLECTIONS

The main question and the sub-questions have been answered above and conclusions on the influence on the perception and use of GIS on agenda-setting and policy design have been drawn. However, there are some things that need to be mentioned and some things that need to be reflected on which do not fit the section on conclusions. Therefore below some reflections will be made on GIS themselves, the research design and some issues regarding the main focus of the research, the influence of GIS on policy design and agenda-setting which have not been mentioned above.

14.4.1 Reflections on Geographical Information Systems

When starting with the reflection on GIS three points stand out. Firstly it is important not to just look at GIS as merely a technology. GIS operates in a social, political and economic world. As the case studies have demonstrated GIS is perceived by different actors in different ways. Mostly the way actors view GIS is in terms of power potential, this constitutes a situation in which GIS should be conceptualized as such. The use of GIS can be used to influence processes of public policy-making as well as the course, the content and the outcome of these processes. Therefore, regarding GIS as a technology in the instrumentalist way does not do justice to the entire concept of GIS.

Secondly it has been demonstrated GIS is not a technology which can only be used in traditional earth sciences. GIS is far more than that and can and is used in fields of policy which do not deal with these traditional earth sciences. More and more are organizations realizing information systems like GIS can be helpful in their cause and their work process. Where, as one respondent mentioned, the GIS department in government agencies was formerly located in the basement, now-a-days GIS departments are viewed as a very helpful and adding department. It is important to reflect on the speed in which GIS has penetrated the world of public policy in different fields and the added value it can have. Further research on GIS and public policy could be very helpful, not only in looking further in terms of agenda-setting and policy design but also in other stages in the policy cycle like monitoring and decision-making.

A third point which needs to be made is that in this research a number of things are said about GIS which could count for each information system. For example the bounds in rationality which can decrease because consequences of implementation are unclear could count for GIS but also for any other multi-functional information system. It is therefore important to not only look at conclusions regarding GIS but it becomes possible to enhance the scope of some of these conclusions to technological information systems in general. However, this is not the case for all conclusions; the distinguishing feature of GIS compared with other technologies is the grounding in geographical locations and the ability to visualize complex data in familiar manners, like a map, movie or virtual world. The conclusions regarding these points naturally can only be drawn for GIS.

14.4.2 Reflections on the Research Design

When looking at the design of the research some reflections need to be made as well. First of all the assumption that it would be helpful to look at existing theories of agenda-setting and policy design and taking out those variables and concepts which proved, in existing literature of GIS, to be helpful in explaining the influence of the perception and use of GIS on agenda-setting and policy design, turned out to be very helpful. This approach made it possible to construct a conceptual framework of both policy design and agenda-setting which was very applicable in this research. However some points in the conceptual frameworks could, in future research, prove to be of more worth if they would be altered.

Secondly in the conceptual framework of agenda-setting the nature of the issue as opposed to the content has shown us that GIS could account for issues becoming less complex. According to the underlying assumptions within the nature of the issue this should make sure the issue would be expanded more easily. In practice this is not the case. The nature of the issue as determining for actions in the policy-sub system does not prove its worth and could be left out of the conceptual framework. This can be explained by the reason the whole concept of the nature of the issue is derived from a body of knowledge dealing with mobilization of citizens. The theory assumes that an issue will reach agenda-status when it is expanded to a large number of people. Of course, in certain cases this might be so but in the cases studied in this research expansion to the public was, in most cases, not so determining. Therefore the concept of the nature of the issue does not fit the conceptual framework well.

Another point is culture. The conceptual framework of agenda-setting is constructed on the basis of existing theories of agenda-setting and the conceptual framework of policy design was constructed on the basis of existing theories of policy design. For this reason in the conceptual framework of policy design culture had a far larger emphasis than in the conceptual framework of agenda-setting. In future research on the influence of GIS on policy design and agenda-setting the variable of culture should be taken in the agenda-setting arena to a larger degree. The reason for this is that risk aversion, a culture of trusting nominal numbers and a culture of being familiar with an issue does influence processes of agenda-setting in the same way it influences processes of policy design but in the conceptual framework of agenda-setting as it is now there is no room to elaborate on this.

Fourthly the selection of cases must be looked at. A selection of cases can hold a bias in itself. The cases used for this research were all based on applications which were implemented in Western Europe. It is arguable the conclusions drawn can be applied more general than just Western Europe. On the other hand it must be noted that implementing GIS in developing countries could have different effects and would ask for different conclusions. It is conceivable that especially in the arena on designing the application dissimilarities might occur. This could possibly be explained by the idea that in practice GIS applications in developing countries are funded and implemented by foreign aid organizations. Another bias in the case selection can be found in the selection criteria themselves. Only new applications were looked at and only innovative projects were considered. It is arguable that implementing a GIS application which was already implemented somewhere else could ask for different conclusions. Especially in the arena on designing the GIS the bounds of rationality might not be so large since lessons can be learned from the original implementation of the application, so consequences can be predicted.

A final remark on the research design relates to the position in the technology debate, social construction of technology. When reflecting on the choice for this position it becomes clear that this position was needed in order to research the influence of the perception and use of GIS on agenda-setting and policy design. Any other position would not have allowed for power relations to be looked at in such an elaborated way. Since the conclusions drawn and the empirical evidence found is for a large part based on power relations, social construction of technology has proven its explaining capacity in this research. Especially when looking at the case of Virtuocity in which the same application was used in two different contexts it can be argued that because the perception of the application was different in both cities the outcomes were as well.

14.4.3 Reflections on Agenda-Setting and Policy Design

Finally there are some remarks and reflections which should be made on the conclusions and comparison of the empirical data. The reason why they belong in the reflection is because they do not add to answering the main question but they could be interesting for future research.

When looking at the theoretical notions of agenda-setting it must be concluded that technology should be taken into the equation. Existing theories on agenda-setting mostly deal with power of individual actors and their ability to push ideas forward or institutional features which empower them to do so. Technology is often taken in but is merely seen as a resource for information or power, like money or status. This research has demonstrated that this does not do right to the position of technology within agenda-setting theory.

Technology should be looked at in terms of its dynamics and not be simply seen as something an actor owns. Technology can alter the process of agenda-setting and therefore can alter the way actors interact with one another and their power relations.

In future research on agenda-setting there are several questions which arise from this view on technology. First of all the question is whether this goes for all technology. Will the use of all forms of ICTs influence the agenda-setting process like the use GIS does? Not only in the degree of influence but also in the actual form of influence. If this is not the case and if there are differences between different technologies the question can be addressed of the reason for these differences. It could be looked at what the characteristics of the technology should be to be able to exert this kind of influence. Are these characteristics in the programming of the technology or is this mere perception of the technology which allows actors to exert influence? A relevant question becomes what the prerequisites are for technology to influence processes of agenda-setting and in what way institutions and groups of actors use these technologies for pushing their issue towards agenda status.

A second question which can be researched deals with new technologies. In this research it is argued that having access to the application as well as the data will empower actors. A number of new applications have arisen in the last decade giving a large number of people access to new applications. Mostly these applications are available over the Internet, they enable users to interactively use the application and the information within the application. Additionally they allow users to share their information. What do these technologies, often referred to as Web 2.0, mean for agenda-setting? In terms of the process of agenda-setting, what is the influence of a large number of people obtaining access to technology and data and how will this influence the chances of issues reaching agenda-status?

For policy design the same can be said as for agenda-setting. Technology is looked at in theories of policy design but again technology is mostly viewed as an asset of a certain actor. The full potential of technology to influence processes of policy design is not acknowledged and therefore under-researched.

Taken the dynamics of technology as demonstrated in this research into account future research on policy design should look at technology as an influential factor and not only as a resource. It becomes important, as it was for agenda-setting, to see whether the conclusions I have drawn on GIS can be generalized to ICTs in a broader sense. Do all forms of ICTs influence processes of policy design the same way as the use of GIS does or are there differences? Is the influence larger, smaller or the same or does the use of other forms of ICTs influence different aspects of policy design processes? A relevant question becomes what the prerequisites of the technology are to influence processes of policy design and whether this can be attributed to the programming of the technology or to the perception of the technology and to which degree.

Another point interesting for research in the field of policy design is the position of experts in the field of the policy issue and computer experts. It has been argued that because of the use of GIS decisions are now made by experts which were formerly made by elected politicians. This corresponds with Winner's thesis (Winner, 1991). In terms of policy design this is interesting to look at and it should be researched what the meaning of this is for policy design and public policy-making in general. Concepts of legitimacy of decisions, democracy and efficiency should be addressed in terms of potential opportunities and threats.

Furthermore it becomes important when looking at technology within the meaning it has been given in this research to deal with rationality. The concept of rationality is largely present in theories on policy design. It is argued in this research that the rationality of policy does not increase as much as one might expect when using information systems which calculate, simulate and communicate. Even though reasons for this have been given the subject should be elaborated on further. Questions arise on to what degree this can be generalized towards all information systems and not only GIS and what the prerequisites are in terms of characteristics and perception of technology in order to increase rationality in policy design.

An important point deals with the emergence of the arena on how to design the GIS application. The emergence of this arena was unanticipated but in each case study it has emerged. The influence of this arena on the arenas on policy design and agenda-setting is very large. Here the issues of access, scope, functionality and how the application is embedded in formal institutions are determined, all of which shape the power relations in the other arena. The emergence of this arena and the influence it might have on public policy should be researched further. A theoretical or empirical body of knowledge is at this point unavailable. When finding theory on this emerging arena one can only look at theories on public policy which deal with two separate arenas, in this way lacking the degree in which the arenas are intertwined. Or one could look at theory in the field of implementing within organizations, in this body of knowledge resistance or conflict in implementation of information systems is regarded as something which should be resolved quickly so the implementation can proceed. In this way this misses the influence this arena can have on the other arenas, furthermore in this body of knowledge only one organization is looked at. Therefore, not only from an academic viewpoint but also in terms of practice of public policy-making it would be an asset and it would probably prove to have added value to study and research the arena in which applications are designed, in terms of influence and occurrence.

In theory this shows that the first arena is very much intertwined with the second arena. When the first arena deals with agenda-setting the process of agenda-setting becomes intertwined with the process of policy design on the application. Because actors in the arena on designing the application anticipate their future power relations they will try to influence the policy design process so that they will be able to exert influence in the future.

It is important to note that in the conceptual framework of both policy design and agenda-setting for the first arena which was used in this research the emergence of a second arena was not anticipated. The conceptual framework therefore lacks a theoretical background to incorporate this second arena. Further research should include the influence of the arena on designing the application in the first arena because the power relations are established in the arena on the design of the application. In future research the influence of the arena on the design of the application should be included as an explaining and determining value in the conceptual frameworks of policy design and agenda-setting.

Two other reflections need to be mentioned. Firstly the bounds of rationality and their link to transparency. GIS are, in a number of studies, said to have the quality of increasing transparency. The bounds of rationality would be lifted because simulations can be made, calculations can be made and outcomes can be visualized in a way a lot of people can understand. In this research it comes forward that on the other hand these bounds in rationality only increase and transparency decreases. This is due to risk aversion and the unpredictability of the consequences of implementing GIS. The crux of the matter lies here, because of this decrease of transparency and therefore risk aversion, certain functionalities of the GIS application are not implemented or are not implemented on the initially intended scale. By doing this, the part in which transparency would increase and the bounds of rationality are lifted loses part of its power. By not implementing part of the GIS application certain calculations cannot be made and communication to all intended becomes impossible. Therefore it so that while an increase in transparency is potentially present in using GIS, due to the decrease in transparency when implementing the GIS, the potential increase is lessened. The same goes for the bounds in rationality. The potential lifting of the bounds of rationality is limited by the increase in the bounds of rationality while implementing.

A final remark which needs to be made on GIS but also on information systems in general is the trusting of nominal numbers. Information systems and GIS can make very complex calculations with enormous amounts of data, and they can make new information visible. But it is still a machine, even though shaped by humans; it still will not produce without being ordered to produce. The fact that through the use of GIS we can now make these calculations and come up with an outcome does not make the outcome holy. GIS will calculate the way it is programmed to calculate. Therefore it can be manipulated on purpose to be used for ones own agenda, or because information on formulas is missing or margins of error are high. Mostly at least experts are aware of this, but sometimes citizens, governments and other experts are as well. In some cases the nominal numbers given as outcomes of calculations are trusted, in others they are not. As mentioned the main reason for this is whether the application demands action, and whether there are more people with access to the application and the data. This process, in a culture where nominal numbers are as important as ours, the dynamics of calculating but also the dynamics of why calculations are sometimes trusted and other times they are not, would be interesting for further research.

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Mr. E Janssen	Waterschap Rivierenland	Tiel	08-05-2007
Mrs. M. Ritzen	Rijkswaterstaat	Delft	14-05-2007
Mr. W. van Gogh	Rijkswaterstaat	Lelystad	21-05-2007
Mr. D. Kroekenstoel	Rijkswaterstaat	Arnhem	23-05-2007
Mr. G-J. Meulepas	Royal Haskoning	Rotterdam	06-06-2007
Mr. S. Hoornstra	Ministerie van Verkeer en Waterstaat	The Hague	03-07-2007

The Riskmap

Mrs. T. Stam	Inter Provinciaal Overleg	Rotterdam	14-08-2007
Mr. P. Glerum	Landelijk Operationeel Coördinatie Centrum/Korps Landelijke Politie Diensten	Driebergen	17-08-2007
Mr. O. Janssen	Provincie Zuid Holland	The Hague	21-08-2007
Mr. H. van Ophuizen	Politie Hollands Midden	Leiden	21-08-2007
Mr. J Wiersma	Geodan	Rotterdam	08-09-2007
Mr. D. van Oosterzee	Ministerie van Binnenlandse Zaken en Koninkrijksrelaties	The Hague	14-09-2007
Mr. J. Pijning	Provincie Noord Holland	Haarlem	27-09-2007
Mr. J. Taanman	Provincie Noord Holland	Haarlem	27-09-2007

TSN

Mr. K. Reimer	Ministerium für Länliche Entwicklung, Umwelt und Verbraucherschutz Brandenburg	Potsdam	07-10-2008
Mr. L. Wieler	Free University Berlin	Berlin	08-10-2008
Mrs. D. Meemken	Hochschule Hannover	Bakum	08-10-2008

Virtuocity

Mrs. J. Horman	Gemeente Tilburg	Tilburg	24-03-2006
Mrs. J. Horman	Gemeente Tilburg	Tilburg	03-05-2006
Mr. B. Van den Berg	Gemeente Helmond	Helmond	03-06-2006
Mr. P. Keijzers	Gemeente Tilburg	Tilburg	22-08-2006
Mrs. E. Kock	Gemeente Tilburg	Tilburg	22-08-2006

Mrs. M. Strik	Gemeente Tilburg	Tilburg	22-08-2006
Mr. P. Keijzers	Gemeente Tilburg	Tilburg	17-09-2006
Mrs. E. Kock	Gemeente Tilburg	Tilburg	17-09-2006
Mrs. M. Strik	Gemeente Tilburg	Tilburg	17-09-2006
Mrs. E. Kock	Gemeente Tilburg	Tilburg	13-12-2006
Mrs. J. Horman	Gemeente Tilburg	Tilburg	16-01-2007
Mr. P. Keijzers	Gemeente Tilburg	Tilburg	16-01-2007
Mr. B. van den Berg	Gemeente Helmond	Helmond	22-01-2007
Mr. T. Veth	CEBRA	Eindhoven	24-01-2007
Mr. S. Tas	Sant en Co Architects	The Hague	26-01-2007
Mr. J. Hamming	Wethouder Tilburg (Partij van de Arbeid)	Tilburg	01-02-2007

Particulate Matter

Mr. A. Hogerbrugge	Rijksinstituut voor Volksgezondheid en Milieu	Bilthoven	14-04-2008
Mr. A. van Zanten	Gemeenteraad Dordrecht (Partij van de Arbeid)	Dordrecht	15-04-2008
Mr. J. Matthijsen	Milieu en Natuur Planbureau	Bilthoven	15-04-2008
Mrs. N. de Smoker	Gemeenteraad Dordrecht (Eco-Dordt)	Dordrecht	15-04-2008
Mr. I. Stumpe	Milieudefensie	Amsterdam	16-04-2008
Mr. A. Bezemer	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer	The Hague	17-04-2008
Mr. D. van Steensel	Wethouder Dordrecht (Christen Democratisch Appèl)	Dordrecht	28-04-2008
Mrs. E. Verkoelen	Zuid Hollandse Milieufederatie	Rotterdam	29-04-2008
Mr. R. Koelemeijer	Milieu en Natuur Planbureau	Bilthoven	23-05-2008

Congestion Charging

Mrs. V. Borwick	Assembly Member Conservatives City of London	London	12-11-2008
Mr. J. Hollis	City of London Transport Researcher	London	12-11-2008
Mr. J. McGoldrick	National Alliance Against Tolls	London	13-11-2008
Mr. R. Kechouri	Transport for London	London	13-11-2008
Mr. S. Kearns	Transport for London	London	13-11-2008
Mr. G. Taylor	Residents group Chelsea	London	24-11-2008

Appendix A

Questionnaire for Agenda-Setting

1. Identification of other actors in the policy sub-system.
   a. Who do you consider other actors or stakeholders dealing with this issue, either positive or negative?
   b. What do you believe their position is in this matter?
2. Perception of technology and more specific Geographical Information Systems.
   a. How do you believe the Geographical Information Systems used will affect your cause?
   b. Do you believe Geographical Information Systems will benefit or harm the cause of others?
   c. Do you believe that the issue at stake would have been different without the use of Geographical Information Systems and if so how?
3. Identification of policy preferences.
   a. Do you consider the issue at stake important and why?
   b. Do you believe the issue at stake actually accounts for a social problem?
   c. Would you be pleased if the issue reached agenda status and why?
4. Identification of factors for power in policy sub-system.
   a. Looking at the other actors you have mentioned above, do you with your cause believe that you will be hindered or helped by them and why?
   b. Which of the actors you have mentioned above in your opinion stand strong in their cause, why so?
   c. If you would have to rank the actors you have mentioned above in terms of their importance how would you do that and why?
   d. If you would have to rank the actors you have mentioned above in terms of who will have the greatest effect on the issue and its agenda status how would you do that and why?
5. Content of the issue.
   a. Could you explain to me what the issue in your opinion is about, what does it entail and what does it deal with?
6. Nature of the issue.
   a. Do you consider the issue to be an abstract issue or a concrete issue? Do you believe that a large deal of people can identify with this issue or do you believe that only a small amount of people will identify themselves with this issue and why?
   b. Do you consider the issue to be important for a large amount of people or do you think the issue only applies for a certain group of people and why?
   c. Do you believe this issue will still have its effects in say ten years or do you believe that the issue is important in the short run and why?
   d. Do you believe this issue is complex do you think a lot of people will understand what the issue is really about and why?

   e. Do you know issues similar to this issue that have been placed on the agenda or decided on already and if so which issues, or do you believe this issue to be new and why?
7. Perception of the national mood and the right time for pushing the proposal forward.
   a. Do you believe there is room in society for the acceptation of this issue and why?
   b. Do you think that a lot of people already have an opinion on this issue and why?
   c. Do you believe that the opinion that is generally held on this issue is positive or negative for the issues chances to be decided on?
   d. Do you think this is the time to put this issue forward opposed to other times, either in the past or the future and why so?
   e. Do you think there are recent events or situations which call for this issue to be put forward and if so which ones?
8. Identification of formal institutions involved.
   a. When thinking about formal institutions which institutions do you believe are involved in dealing with this issue?
9. Nature of these institutions.
   a. Do you believe these institutions you have mentioned to be helpful or harmful for your cause and why?
   b. Do you think these institutions have a lot of power in helping or harming your cause and why?

Appendix B

Questionnaire for Policy Design

1. Identification of actors in the action arena.
   a. Who do you consider other actors or stakeholders dealing with this issue, either positive or negative?
   b. What do you believe their position is in this matter?
2. Perception of technology and more specific Geographical Information Systems.
   a. How do you believe the Geographical Information Systems will affect your cause?
   b. Do you believe Geographical Information Systems will benefit or harm the cause of others?
   c. Do you believe that the issue at stake would have been different without the existence of Geographical Information Systems and if so how?
3. Identification of policy preferences
   a. Could you explain the issue and your preferred alternative to me?
   b. Do you consider the general issue at stake important?
   c. Do you believe t he issue at stake actually accounts for a social problem?
   d. Would you be pleased if the issue actually was decided on and why?
4. Identification of factors for power in the action arena
   a. Looking at the other actors you have mentioned above, do you with your cause believe that you will be hindered or helped by them and why?
   b. Which of the actors you have mentioned above in your opinion stand strong in their cause, why so?
   c. If you would have to tank the actors you have mentioned above in terms of their importance how would you do that and why?
   d. If you would have to rank the actors you have mentioned above in terms of who will have the greatest effect on the issue and its content how would you do that and why?
5. Identification of the formal institutions involved
   a. When thinking about formal institutions which institutions do you believe are involved in dealing with this issue?
6. Nature of these institutions
   a. Do you believe these institutions you have mentioned to be helpful or harmful for you cause and why?
   b. Do you think these institutions have a lot of power in helping or harming your cause and why?
7. Identification of the rules in use
   a. How do, in terms of these issues at stake, interaction between groups normally proceed?
   b. How are issues like the present issue normally dealt with, what is the normal course of events?

8. Prevailing values and norms
   a. Do you believe there is room in society for the acceptation of this alternative and why?
   b. Do you think that a lot of people already have an opinion on this alternative and why?
   c. Do you believe that the opinion that is generally held on this issue is positive or negative for the alternatives chances to be decided upon?
9. Degree of rationality
   a. Do you believe all alternatives for this problem have been looked at, and why?
   b. Do you believe all possible consequences are calculated, and why?
   c. Do you believe this alternative and this issue are dealt with in a rational matter, why so?
   d. Do you believe that decisions regarding the alternative are made on the basis something other than rationality, for example creativity, risk taking, a good or bad feeling?
10. Degree of satisficing
    a. Do you believe the present alternative to be the best alternative possible? Can you envisage a better alternative?
    b. Do you believe the present alternative to be good enough? If not, what is wrong with it?
    c. In the future, would you wish to make changes to the alternative if you could?

Summary

There are a number of issues relating to public policy which concern us everyday, some are minor and some are larger. Not all of these issues are actually discussed within politics or public administration. There are several issues which will not be addressed at all, not the problem itself, nor the way others perceive this problem, 0no solutions are addressed and no alternatives listed. The issue itself does simply not reach the political agenda. When an issue actually manages to obtain agenda status this does not mean new policy will be made on this issue. First this policy needs to be designed. What is meant by policy design is the process before the actual decision-making or implementation stage. Policy design is therefore seen as the process in of defining, considering and accepting or rejecting options for political decision.

Technology is used more and more to enhance these processes of agenda-setting and policy design. Different forms of ICT are used to expand issues to a greater audience, for example through the Internet, but also to make sure governments are aware of the issue at stake. Furthermore, forms of ICT are used in policy design, for example, they can help to calculate the costs and benefits of alternative solutions. Also they can make sure that those who own the ICT application hold an information monopoly, which accounts for their preferred solution to be more likely to be chosen. It is therefore to be expected that ICT applications could have a large effect on processes of agenda-setting and policy design. However, while the effect of the use of ICT on processes of agenda-setting and policy design has been researched to a certain degree, the influence of specifically Geographical Information Systems (GIS) has received little attention. At the beginning of the ICT hype in the early 1990s governments were unaware of how much of their information was spatially based. They were stunned to see that GIS could be used in more fields than just the traditional geo-sciences. Now, even though the use of GIS in the public sector has become common practice in a number of different fields, the effects of the use of this technology in terms of agenda-setting and policy design are still very poorly researched. Questions on how the use of GIS could influence the way these processes develop are not addressed, as well as the question of how the use of GIS could influence the content or the outcome of these processes.

This research therefore focuses on this question, the main question asked which this research aims to answer is:

> *How does the perception and use of Geographical Information Systems by different actors influence the course, the content and the outcome of processes of agenda-setting and policy design?*

In order to answer this question it is first important to look at what GIS actually is. GIS are forms of ICT which hold the same features as other ICTs except that the data used for GIS is spatially based and that GIS has an advanced feature of visualization. Furthermore it is to be seen that GIS can manage, order, analyze and calculate large quantities of data while using different layers placed on top of each other.

Even though GIS has been around since the late sixties of the past century, during the ICT hype a lot of different organizations and parts of government realized GIS could be useful in fields which did not deal with traditional earth sciences. Expectations of the potential and potential use of GIS were very high. It was expected that policy-making would become more rational, that every organization would share their data, that policy and policy-making would become more transparent. Now GIS is indeed used in a lot of different areas of public policy and some of these expectations have indeed come true. The qualities and functions attributed to GIS include increased integration, not only of datasets but also of work processes, making sure organizations work together. Secondly GIS can make enhanced calculations, making it possible to do simulations and calculate effects. A third quality is visualization which makes sure complex data can be viewed in a simple way. Fourthly increased and improved communication is mentioned, because of the visualization and integration functions. Finally increased transparency, in the work process but also in the policy process itself is listed.

However, even though these qualities and functions are present in research by several authors, there are factors limiting this potential. These factors are recognized by several authors. A first factor is that sharing of data does not always move as smoothly as hoped for, because of conflicts of interests. Contacts between organizations are often lacking and privacy and intellectual property rights limit the sharing of data as well. Another factor is that datasets are often incompatible which demands for restructuring and standardization. This often poses a problem since organizations fear losing autonomy. Knowledge on how to operate a GIS is also a limiting factor in fulfilling expectations as well as distrust of data. The data itself is often not available or very expensive.

This demonstrates that even though the potential is there and can be found in empirical cases this potential is also limited. These limiting factors could also be present in the use of GIS in agenda-setting and policy design.

After looking at what GIS is and how it is perceived it is important for the answering the research question to find an epistemological position by which technology can be looked at. It is needed to look at GIS on a higher level, this in terms of what GIS means, what their relation towards society is and what this relationship could be. It is necessary to find an epistemological position to look not only at technology but also at society, policy and humans. This has to be done in order to make sure this research can be conducted in a way in which the collection of data and the analysis of this data proceed in a coherent manner. Therefore it is important to establish which epistemological position is advocated and will be used to value reality. In order to find this epistemological position the technology debate can be looked at, in which four positions are dominant. The first viewpoint is technological instrumentalism in which technology is seen as a tool which can be used to serve the users intention. Secondly the approach of technological determinism can be found. Within this approach technology is attributed with agency and is regarded as holding values of its own. Technology cannot be steered or directed. Thirdly in social construction of technology, technology is seen as a social construct and humans have shaped the technology into what is has become. Finally in the approach of information ecology technology and society are intertwined like a biological ecology, influencing each other. When looking at GIS the viewpoints of social construction of technology would be the most fitting viewpoints. This because firstly the main question of this research demands for an approach in which perception is not only emphasized but can also be explained according the same lines of the approach. Furthermore, social construction of technology is able, contrary to technological determinism and technological instrumentalism to account for the complexity of the processes of agenda-setting and policy design. Secondly social construction of technology is the most fitting viewpoint since empirical evidence suggests so. Social construction of technology can account for the potential enhancing qualities and effects of GIS. Also this position can offer an explanation why these qualities and effects do not occur every instance. The same goes for the limiting effects GIS can have. The reason then that social construction of technology is chosen as dominant viewpoint in this research over information ecology can be justified by chronology. While information ecology assumes that technology influences society right away through its embedded values, social construction of technology assumes that technology can only do so after it is shaped, with the values given to technology in the process of shaping. Empirical case studies support the latter.

This means that technology, GIS, society and humans as well as the processes of agenda-setting and policy design, with their course, content and outcome, in this research will be looked at from a social construction of technology viewpoint. This will come back in the construction of the conceptual frameworks. This will have some methodological implications which will be elaborated on in a later chapter.

The second part of the main question deals with agenda-setting and policy design and their course, content and outcome. In this research agenda-setting will be regarded as the process of getting a subject or a problem to gain this attention from government or those closely related to government. Within this definition several theories of agenda-setting are looked at which provide for a capacity in explaining the influence of the perception and use of GIS on the process of agenda-setting. Firstly the barrier model is discussed. In this model it is assumed that an issue must pass two barriers in order to obtain agenda status, first the barrier of fitting dominant values in society and secondly the barrier of institutional procedures. Secondly the Cobb and Elder model is elaborated on. Here it is assumed that for an issue to reach agenda-status it must be expanded to a larger public, whether this happens is dependent on the nature of an issue in contrast to the content. A third theory which was discussed is the stream model. Here the idea of the stage heuristics is dropped and problems and solutions float around until they find each other, together with a positive political climate and the opening of a policy window the issue could reach agenda status. Finally the advocacy coalition framework is explained. Here also the stage heuristic is left behind and it is assumed that several advocacy coalitions negotiate on the content of the issue but also on getting it on the agenda.

Policy design is seen as the process of designing, considering, rejecting and accepting options or alternatives for a policy problem and to formulate them into a policy proposal on which later on can be decided. The decision-making process will thus not be discussed. Taken this definition into account, several theories of policy design are looked at in order to find concepts and variables which can help researching the influence the use and perception of GIS can have on policy design. Most of these theories were reactions to the rational actor model which assumes that humans are able to list all the possible alternatives, calculate all the consequences of these alternatives and in the end pick the alternative which is most favorable. The first theory discussed is the satisficing model; here it is believed that humans cannot display the degree of rationality assumed by the rational actor model. Humans are bound in the degree of rationality they can display and therefore, together with the fact that time and resources are often lacking, actors opt for a sub-optimal solution that fits the criteria of being satisfactory. A second theory which is elaborated on was successive limited comparisons, here as well it is assumed that humans are limited in the degree of rationality they can display. Furthermore it is believed that actors should choose those alternatives that do not differ severely from the present situation, making sure they do not opt for radical change which can have unforeseen consequences. Thirdly mixed scanning is explained, this is a mix between the rational actor model and successive limited comparisons. It prescribes to first scan all possible alternatives very generally and then look in detail at the alternatives which look viable in the scan. The normative optimum model is also a reaction to the rational actor model and successive limited comparisons, in this model the bounds of rationality are acknowledged but extra rational components are added. Finally the institutional analysis and development framework is looked at. In this framework actors negotiate on a proposal in the action arena and their actions are constrained or enhanced by culture, rules in use and attributes of the physical world.

In answering the research question now definitions have been given and it is explained what GIS is from a rationalistic viewpoint as well as how to look at it from a more epistemological position. The next step to take in answering the research question is to construct a conceptual framework by which case studies can be analyzed. While a position in the technology debate was already chosen it becomes important to look at an epistemological position to look at not only technology but at reality as a whole. It is argued that social constructivism is the most suited position to hold within this research. The core of the theory of social constructivism consists of the idea that everything in reality is shaped by humans, is a social construct, this can be seen in the function: X counts as Y in context C. Furthermore, after institutions are shaped and helped to shape other institutions, they, within the meaning they have been given, influence society. This means that technology, GIS, society and humans as well as the processes of agenda-setting and policy design, with their course, content and outcome, in this research will be looked at from a social constructivist viewpoint.

Now the relevant concepts from social constructivism, social construction of technology and theories of agenda-setting and policy design have come together in a conceptual framework. The core of the conceptual framework of agenda-setting can be summarized by stating that there is a policy sub-system, in which interaction is influenced by formal institutions, the nature of the issue and the policy window. The policy sub-system is also influenced by technology which, after it is shaped by the actors, constraints and facilitates the actions in the policy sub-system through the technological frames the different groups of actors have. Once established, the technology will influence the structure. In the policy sub-system several groups try to push their values, which could conflict with values held by other groups, forward in order to come towards a situation in which their preferred issue reaches agenda status. They do so within their technological frame and with their relative power. Finally agreement will be reached and one alternative will be chosen as the alternative that will constitute for the issue which reached agenda status.

The conceptual framework of policy design operates for a large part in the same way. This means that there is an action arena, in which interaction is influenced by formal institutions, rules in use and culture. The action arena is also influenced by technology which, after it is shaped by the actors, constraints and facilitates the actions in the action arena through the technological frames the different groups of actors have. The technology will influence the structure. In the action arena several groups try to push their values, which could conflict with values held by other groups, forward in order to come towards a policy design matching their values. They do so within their technological frame and with their relative power. All actors are limited in the degree of rationality they can demonstrate. They will aim for a satisficing solution; first because time and resources are scarce, second because they know consensus has to be made. Finally agreement will be reached and one alternative will be chosen as the alternative that will constitute for the policy design.

The conceptual framework is used to analyze the case studies. In this research the choice is made to combine several research strategies, this is called methodological triangulation. This method involves that the strengths of several theories can be combined neutralizing each others weaknesses. This combination of different methods will consist of firstly examining existing material. A second method which will be used is case study research;

six case studies will be conducted. This can make sure that empirical evidence can be directly found and observed. Within the case studies the material that will be obtained is three fold. Firstly written information will be looked at; these can be legal documents, government reports, policy documents and news publications relevant to the sector, the layers of government and the GIS application. Secondly semi-structured interviews will be conducted with stakeholders in order to make sure their perception of issues and other actors can be researched. Finally some observation will be done. Interaction between actors will be looked at and the GIS application in the case study will be worked with. It must be noted the six case studies will be used to come to an analytical generalization of the influence of the perception and use of GIS on agenda-setting and policy design. In choosing these case studies there are a number of selection criteria which are used to pick just these cases. The first criterion is that the GIS application must be new in its field; the innovative character must be high. A second criterion can be found in the policy cycle. Since this research deals with agenda-setting as well as policy design it is important to balance cases between the two. Therefore three cases are conducted in the field of agenda-setting and three in the field of policy design. Thirdly the case studies must all encompass a different field of policy. This is important since the research has an explorative character in explaining the influence of the perception and use of GIS in agenda-setting and policy design in general, not in one specific field of policy. A fourth criterion is the layer of government, in order to explain the influence of the perception and use of GIS on agenda-setting and policy design it is important to look not only at the national level, the case studies are spread over the layers of government. Two of the cases are local, two cases are conducted at a provincial level and two cases are conducted at the national level.

The first case dealt with is HIS and FLIWAS, a GIS application which is used to monitor water levels in the Netherlands and Germany. The application is also used to predict floods and the consequences of these floods in terms of economical damage, evacuation and victims.

The second case which is researched was the case of The Riskmap. This is a GIS application used by the Dutch government to inform citizens on internal risks in their neighborhood. These risks include storage of dangerous substances and industries potentially damaging.

The third case which is researched in the field of agenda-setting was the case of TSN. Here a GIS application is used by the German government to obtain insight in contagious live stock diseases. The application can calculate consequences of an outbreak and will calculate effects of measures for prevention and containment.

The first case dealing with policy design is Virtuocity in two cities. This is a GIS application used by the Dutch municipalities of Tilburg and Helmond. This application views building plans for the urban centers in a three dimensional way so citizens can view their city, comment on the plans, and in some cases vote for several alternatives.

The fifth case deals with particulate matter. In this issue a GIS application is used by the Dutch government to measure concentrations of particulate matter in real time or as consequence of a potential building plan. On the basis of this application building plans can be stopped.

The final case researched is Congestion Charging. Here a GIS application is used in London. The application is able to monitor congestion but is also able to calculate consequences of measures to reduce congestion.

After dealing with the empirical material, the case studies, some conclusions can be drawn and an answer to the main question can be found.

Since the main question can be divided into the part in which the influence of the perception and use of GIS on the course, the content and the outcome on agenda-setting is researched, and secondly on policy design, the conclusions will be described accordingly.

A first conclusion in the field of agenda-setting deals with closure on the meaning of technology. In other words, do all actors perceive the technology the same way. Empirical evidence shows us whether closure on the meaning of the application occurs is dependent on the goal of that application itself. An application which demands action achieves closure on the meaning of technology less quickly than an application which is only used for communication. Furthermore an application with a large scope and a large number of functionalities will reach closure far less likely than a simpler application. The issue itself is important too, a highly politicized issue does not help closure to occur. The presence or absence of closure on the meaning of the technology does influence the process of agenda-setting.

The second conclusion deals with power, when using GIS in issues of agenda-setting empirical reality shows power relations between involved actors can change. Actors without power can become empowered and actors who were in power can lose this power. This can be explained by the idea that by using GIS new information becomes visible through the functions of integration, calculation and visualization. Those who have access to this information gain in power significantly over those who do not. It is not only the data which gives them this power but also the application. The raw data alone is not enough for this shift in power but it is the application that allows the calculations, the simulations and the scenario sketching which enforces this power. Since GIS is an application which can do so it can be stated that the 'war on data' as it was called decades ago is not applicable anymore since the application itself is important to a far larger degree. This shift in power can be seen mostly in a shift of power to experts and technicians; they with the use of GIS can communicate their ideas to policy-makers and the public in an understandable way and can visualize consequences of alternatives. Furthermore, through standardization organizations can integrate making them a powerful block. Also the public could gain in power when the GIS application was designed to inform them. It must be kept in mind the gain in power is a perception of the actors involved, whether closure on the meaning of the technology has occurred or not. Those who are perceived to have more power will act as such and will eventually gain this power.

A third conclusion which must be drawn relates to the second conclusion, even though power relations are significantly altered by the perception of GIS, some are empowered and others are not, this is not a random process. Empirical data shows us that it depends on the initiator of the GIS application who is empowered by this application. When the GIS application is initiated by the government, it will mostly empower the government and will help push forward their ideas. However, when this is not the case and the GIS application is initiated by another actor, the ideas of this actor will be helped by GIS. The power they gain seems to be less however than the power the government gains when they initiate the application. This can be explained by the fact that when the government initiates the application all is laid down by formal laws and regulations, making discussion impossible, other actors do not have this power.

The fourth conclusion which must be drawn does not deal with power but with the GIS application itself. Where agenda-setting deals with pushing forward new ideas, new problems and new views with the goal to gain them agenda status GIS can offer an opportunity to do so. In each case study researched the GIS application itself caused the opening of a policy window. GIS accounts for integration of different datasets, the calculations and the outcomes deriving from this. Furthermore the visualization function of GIS allows actors to make sure a large group of people understand their ideas. Because of this new issues can be found, new problems arise and new possibilities emerge, these possibilities are not only seen by experts using GIS but also by policy-makers and in some cases the public. This accounts for the opening of a policy window. Therefore because of the implementation of a GIS application a policy window opens through which new ideas can be pushed forward which were generated by the GIS application itself.

When looking at conclusions dealing with the influence and the perception and use of GIS on the course, content and outcome of policy design, the conclusions are similar to agenda-setting for a large part. However there are some differences to be found.

Like for agenda-setting a first conclusion must be drawn on closure on the meaning of the technology, sometimes it occurs and sometimes it does not. As for agenda-setting this depends on the scope of the application, the goal of the application and the degree of politicization of the issue. But there is another factor which comes forward, namely who has access to the data and the application. When there is only one actor with access to both this actor can use this application to push his idea forward. When a number of actors have access this is not possible anymore and no single actor can use the GIS application to push his ideas over others. Giving a large number of different actors access to the application could therefore increase the likelihood of closure on the meaning of the technology.

A second conclusion is, similar to agenda-setting, that power relations are dramatically altered by the use of GIS in policy design. Actors who had power might lose this power and actors who priorly had no power might now be empowered. Those with access to both the application as well as the data gain in power. They are the ones deciding which calculations to make and what information to show and share. They perceive the GIS application as empowering and they will act as such. Those who perceive the GIS application as threatening will behave accordingly.

The third conclusion corresponds with one of the conclusions in the agenda-setting arena as well. Here in the policy design arena it is important who initiated the implementation of the GIS application. The actor initiating the application will make sure the application serves his goals. Again, if this actor is the government they will be even further reinforced since they are able to ground the application in formal laws making alterations to the application or discussion impossible.

Next to conclusions which correspond with the conclusions drawn for agenda-setting, some policy design specific conclusions must be drawn. It must be noted that by the use of GIS bounds in rationality decrease. Because GIS can calculate large quantities of data and present this data in a way a lot of people understand, and because simulations can be made and effects can be viewed it becomes possible to design policy in a more rational way. This means for the course of the process of policy design that actors are more able to communicate with each other, through integration and visualization functions of GIS. The content of the course of policy design as well as the outcome are severely affected by this decrease in the bounds of rationality. Due to increased transparency, the calculations, the simulations and the new information which can be made the content as well as the outcome of the policy design process changes. New issues may arise and new possibilities can emerge and can be looked at as serious alternatives. The outcome of the process than becomes not only more rationally based but can also be backed by simulations and improved calculations. Another conclusion than can be drawn on the influence of the perception and use of GIS can have on processes of policy design is that culture and the rules in use affect policy design. The use of GIS can interfere with existing rules in use and culture. First of all we see a rule in use as well as a culture of trusting nominal numbers. While calculations in GIS are based on nominal numbers it would seem a GIS application would be trustworthy, this is not always the case. Due to large margins of errors and insecurities in these numbers and formulas the outcome of a calculation can be perceived as illegitimate and as a way for actors to push their ideas forward. This shows us the calculations GIS make do not always account for a more rational final design but can also cause serious conflict. For the process of policy design this means conflict is opened on the trustworthiness of the application and its functionalities, the course of the process is influenced.

These conclusions however, do not answer the main question completely yet. In empirical reality it was found that next to the agenda-setting arena and the policy design arena another arena emerged while using GIS. This is the arena in which the GIS application was designed.

The fact that this arena emerges simultaneously with the arena on a specific policy issue is a conclusion. Therefore it can be claimed when implementing technology and specifically complex and multi-functionality applications like GIS, another arena emerges in which policy needs to be designed on how to design the application. In some situations the actions in the first arena (agenda-setting and policy design) occur simultaneously with the actions in the second arena on designing the application. Sometimes the designing of the second arena partly precedes the arena of agenda-setting and policy design. It is important to understand that in the second arena, the arena of designing the GIS application, a large deal of the ground is covered on which closure on the meaning of the technology can or cannot occur. As concluded above, the initiator of the application, who has access to the data and the application, the scope and the goal of the application determine for a large part whether closure on the meaning of technology occurs. Also power relations in agenda-setting and policy design processes determine this. It is this arena in which these matters are determined. Therefore in order to understand processes of policy design and agenda-setting when dealing with GIS the arena in which the GIS is designed must be understood, acknowledged and dealt with.

When looking inside this arena a number of conclusions can be found. As for the two other arenas it is important to look at closure on the meaning of the technology. What is important here is that the reasons, the scope and functionality of the application as well as who has access to the application, are determined in this arena. The outcomes in the policy design process of GIS influence the arenas of agenda-setting and policy design on policy issues later. When closure on the meaning of technology occurs in this arena it is more likely that closure on the meaning of technology will also occur in other arenas in which the application is used.

A second conclusion is also the same as in the two arenas described above. Namely that in this arena, even though this is the arena in which GIS are designed, power relations alter when dealing with GIS. Those who will have access to the data and the application gain in power, their perception of their gained power will make sure they behave accordingly; they perceive the GIS application at stake as empowering them over others. Here it is found the initiators of the application mostly decide who has access to the application and mostly grant themselves access. Therefore they benefit in two ways, they are the ones with access and they determine the goal of the application since they are the initiator, making sure the application serves their purpose. This seems the same as in the other two arenas but it must be noted that in the arena of designing the GIS application far more conflict can be found. Because in this arena it is not clear yet who will be granted access and for what purposes the GIS application will be used there is more room for conflict, all actors would like GIS to empower them.

The third conclusion in this arena is also similar to the conclusions drawn in the other two arenas, namely that the initiator of the application holds a lot of power since the initiator is able to decide how the application is going to look. What is different in this arena is that when the government initiates the application it is indeed reinforced because it can lay the ground rules of the application down by law. However, if it is not the government who initiates the application in this arena the initiator might be seriously hindered by formal institutional features, mainly because organizations can be much fragmentized.

Fourthly the bounds of rationality must be looked at. In the previously discussed arena the bounds of rationality were lifted by the use of GIS, in this arena they increase. The reason for this is that in this arena there are no calculations or simulations to be made and there is nothing to visualize. In this arena actors deal with a new application which is often not even completely developed, what the consequences of this application will be, economically, socially and politically, is completely unclear since there is no precedent. What this means for policy design in this arena is the whole process is characterized by a mood of risk aversion, some functionalities of GIS are not implemented, some actors will not be granted access, the scope of the application is shortened and so further. The content of the process is also altered because actors are afraid of the consequences of implementing the application they are reluctant to put all the possible functionalities into the GIS application. Furthermore they have to balance between issues of accountability, insecurities in calculations, in- or excluding groups and costs of the technology. Therefore these bounds of rationality influence the content as well as the outcome severely.

As a fifth conclusion it must be noted where satisficing as a concept was not very clearly present in the arena on policy fields in this arena it is. Because of the risk averting behavior, because integration cannot always be established due to autonomy issues, because communicating all information cannot always be achieved, because the balance between complete information and still remaining understandable without being overloaded and because time and money are pressing. The content and the outcome of the process is therefore often sub-optimal.

Another conclusion can be drawn on culture, the leading culture often accounts for how GIS applications are perceived and communicated. Next to a culture of risk aversion as described above there is also a culture of the government keeping all decisions in its own hands. In this way limiting conflict in this arena but also making sure they hold power, since the initiator, especially when this is the government, holds most power.

Samenvatting

Er is een groot aantal onderwerpen binnen het publieke bestel waar we elke dag mee te maken hebben. Niet al deze onderwerpen worden feitelijk besproken door de politiek of het openbaar bestuur. Er zijn onderwerpen die helemaal niet besproken worden: het probleem niet, de probleemperceptie niet en ook de mogelijke oplossingen niet. Het onderwerp haalt simpelweg de politieke agenda niet. Wanneer een onderwerp deze politieke agenda wel bereikt, betekent dat niet dat er ook beleid betreffende dit onderwerp gemaakt zal worden. Dit beleid zal eerst ontworpen moeten worden. Het ontwerpen van beleid refereert aan het proces dat (aan) de besluitvorming of implementatie voorafgaat. Beleidsontwikkeling is dus het proces van het definiëren, overwegen en accepteren of afwijzen van alternatieven voor een politieke beslissing.

Technologie wordt steeds meer gebruikt om deze processen van agendavorming en beleidsontwikkeling te ondersteunen. Verschillende toepassingen van ICT, bijvoorbeeld het internet, worden gebruikt om aandacht van een groot publiek te vragen voor verschillende onderwerpen. Ook zorgen deze toepassingen van ICT ervoor dat overheden zich meer bewust worden van zaken die spelen in de samenleving. Daarnaast worden ICT toepassingen gebruikt in het ontwerpen van beleid, zij kunnen bijvoorbeeld helpen kosten en baten analyses van verschillende alternatieven te maken. Ook kunnen zij ervoor zorgen dat degene die de ICT applicatie bezit een informatie monopolie heeft, waardoor de oplossing die hij voorstaat een grotere kans heeft om tot beleid gevormd te worden. Het wordt verwacht dat ICT applicaties een groot effect hebben op processen van agendavorming en beleidsontwikkeling. Dit effect van het gebruik van ICT op processen van agendavorming en beleidsontwikkeling is onderzocht maar de invloed van geografische informatiesystemen (GIS) heeft daarin weinig aandacht gekregen. Aan het begin van de ICT hype, tijdens de vroege jaren '90, waren overheden zich er niet van bewust hoeveel van hun informatie feitelijk op ruimtelijke data gebaseerd was. Overheden waren verbaasd te zien dat GIS in veel meer sectoren gebruikt kon worden dan slechts in de traditionele aardwetenschappen. Tegenwoordig wordt het gebruik van GIS in het publieke domein als algemeen geaccepteerd beschouwd, toch zijn de effecten van het gebruik van deze technologie in termen van agendavorming en beleidsontwikkeling beperkt onderzocht. Hoe het gebruik van GIS de manier waarop deze processen verlopen beïnvloedt, is niet onderzocht, evenals de vraag hoe GIS de inhoud en de uitkomst van deze processen kan beïnvloeden.

Om deze reden zal dit onderzoek zich richten op die vragen. De hoofdvraag die dit onderzoek tracht te beantwoorden luidt als volgt:

Hoe beïnvloedt de perceptie en het gebruik van geografische informatie systemen door verschillende actoren het verloop, de inhoud en de uitkomst van processen van agendavorming en beleidsontwikkeling?

Om deze vraag te beantwoorden is het belangrijk te kijken naar wat GIS feitelijk is. GIS zijn vormen van ICT die dezelfde kenmerken hebben als andere vormen van ICT maar de data die gebruikt wordt, is altijd ruimtelijk georiënteerd en GIS heeft een geavanceerd kenmerk van visualisatie. Verder kunnen GIS grote hoeveelheden data managen, organiseren, analyseren en calculeren door verschillende lagen met data op elkaar te plaatsen.

Hoewel GIS sinds de jaren '60 van de vorige eeuw in gebruik is, realiseerden overheden en andere organisaties zich pas tijdens de ICT hype dat GIS ook nuttig kon zijn in sectoren die niet onder de traditionele aardwetenschappen vallen. Verwachtingen over het potentieel en het potentiële gebruik van GIS waren hoog. Er werd verwacht dat beleidsmakers rationeler konden beslissen, dat elke organisatie haar data zou delen en dat beleid en beleidsvorming transparanter zou worden. Tegenwoordig wordt GIS inderdaad gebruikt in veel verschillende sectoren van beleidsvorming en sommige van deze verwachtingen zijn inderdaad waargemaakt. Een van de eigenschappen en de functies die aan GIS toegeschreven kunnen worden, is een verbeterde integratie, niet alleen van datasets maar ook van werkprocessen, zodat organisaties kunnen samenwerken. Ten tweede kan GIS verbeterde calculaties maken, waardoor het mogelijk wordt simulaties te doen en effecten te berekenen. Een derde kenmerk van GIS is visualisatie, hierbij kan complexe data op een relatief simpele manier bekeken worden. Ten vierde wordt een verbeterde communicatie aan GIS toegeschreven, door de visualisatie en integratie functies. Tot slot wordt er gesproken over een toegenomen transparantie, zowel in het werkproces maar ook in het beleidsproces.

Hoewel deze kenmerken en functies in verschillende onderzoeken onderzocht zijn, zijn er ook factoren die dit potentieel beperken. Deze factoren zijn eveneens door verschillende onderzoeken onderkend. Een eerste factor is dat het delen en uitwisselen van data niet altijd zo soepel verloopt als er gehoopt werd, dit door conflicterende belangen. Contacten tussen organisaties zijn vaak niet optimaal en wetten met betrekking tot privacy en intellectueel eigendomsrecht beperken het uitwisselen van data nog verder. Een tweede factor is dat datasets vaak niet compatibel met elkaar zijn, dit vraagt voor een reorganisatie van de dataset of voor standaardisatie. Dit veroorzaakt vaak problemen omdat organisaties vrezen autonomie te verliezen. Kennis over hoe een GIS applicatie te gebruiken, is ook een beperkende factor in het vervullen van verwachtingen evenals het wantrouwen van de data. Tot slot is de data vaak niet beschikbaar of erg duur.

Dit laat zien dat ondanks dat het potentieel van GIS bestaat en gevonden kan worden in de empirie, dit potentieel gelimiteerd is. Deze beperkende factoren kunnen dus ook aanwezig zijn in het gebruik van GIS in processen van agendavorming en beleidsontwikkeling.

Na het beschrijven wat GIS is en hoe er naar GIS gekeken wordt, is het belangrijk voor de hoofdvraag om een epistemologische positie te vinden waarmee naar de technologie gekeken kan worden. Het is noodzakelijk om GIS te bezien vanuit een hoger niveau, in termen van wat GIS betekent, wat de relatie tussen GIS en de samenleving is, en wat deze relatie zou kunnen zijn. Het is nodig een epistemologische positie te vinden om niet alleen naar technologie te kijken maar ook naar de samenleving en de politiek. Op deze wijze kan dit onderzoek uitgevoerd worden op een manier waarin het verzamelen van data en de analyse van deze data op een coherente manier verloopt. Om deze reden is het belangrijk te bepalen welke epistemologische positie in dit onderzoek dominant is. Deze zal gebruikt worden om de realiteit te beoordelen. Om deze epistemologische positie te vinden kunnen we kijken naar het technologie debat, hierin zijn vier posities dominant. De eerste positie is technologisch instrumentalisme, hierin wordt technologie gezien als een gereedschap dat gebruikt kan worden door de gebruiker om zijn doel te bereiken. Een tweede positie is technologisch determinisme. Binnen deze positie wordt 'agency' toegekend aan technologie en heeft technologie in zichzelf waarden. Technologie kan dus niet gestuurd worden. Een derde positie is sociale constructie van technologie, hier wordt technologie als een sociaal construct gezien. Mensen hebben de technologie gevormd tot wat het is geworden. Tot slot bestaat er de positie van informatie-ecologie waarin technologie en de samenleving verweven zijn als een biologische ecologie, zij beïnvloeden elkaar. Wanneer we kijken naar GIS passen de assumpties van sociale constructie van technologie het best binnen dit onderzoek. In de eerste plaats omdat de hoofdvraag van dit onderzoek vraagt voor een positie waarin de perceptie benadrukt wordt en ook behandeld kan worden. Verder is sociale constructie van technologie als positie in staat, in tegenstelling tot technologisch determinisme en technologisch instrumentalisme, de complexiteit van de processen van agendavorming en beleidsvorming te duiden. Daarnaast lijkt sociale constructie van technologie de meest passende positie omdat de empirie dit suggereert. Binnen sociale constructie van technologie kunnen we de potentieel verbeterende kenmerken en functies van GIS meenemen. Daarbij kan deze positie ook uitleggen waarom deze kenmerken en functies niet altijd het gehoopte potentieel bereiken. De reden dat sociale constructie van technologie boven informatie-ecologie gekozen wordt in dit onderzoek kan verantwoord worden in termen van chronologie. Waar informatie-ecologie aanneemt dat technologie de samenleving direct beïnvloedt door de ingebedde waarden, neemt sociale constructie van technologie aan dat technologie dit pas kan doen nadat het gevormd is, met de waarden die in het proces van vorming aan de technologie zijn toegekend. Empirisch onderzoek ondersteunt dit.

Het tweede deel van de hoofdvraag behandelt agendavorming en beleidsontwikkeling, hun verloop, inhoud en uitkomst. In dit onderzoek zal agendavorming gezien worden als het proces waarin een onderwerp of probleem aandacht van de overheid, of direct betrokken organisaties, krijgt. Binnen deze definitie kan er naar verschillende theorieën van agendavorming gekeken worden die allen de potentie hebben de invloed van de perceptie en het gebruik van GIS in het proces van agendavorming te verklaren. Een eerste theorie die besproken wordt, is het barrière model. In dit model wordt aangenomen dat een onderwerp twee barrières moet nemen om agenda status te verkrijgen. Eerst is dat de barrière van passendheid met dominante waarden in de samenleving en de tweede barrière is de barrière van institutionele procedures. Ten tweede wordt het model van Cobb en Elder uitgelegd. In dit model geldt de assumptie dat uitbreiding naar een groter publiek de voorwaarde voor een agenda status is. Of dit gebeurd, is afhankelijk van de vorm van het onderwerp in tegenstelling tot de inhoud. Een derde theorie die besproken wordt, is het stromenmodel. Het centrale idee in dit model is dat de aanname van verschillende opeenvolgende beleidsstadia verworpen wordt. Problemen en oplossingen zweven in het rond tot zij elkaar vinden, samen met het goede politieke klimaat en de opening van een ‘policy window’ kan een onderwerp agendastatus verkrijgen. Tot slot is er gekeken naar het advocacy coalition framework. Hier wordt ook de aanname van opeenvolgende beleidsstadia verworpen. Het wordt aangenomen dat verschillende coalities onderhandelen over de inhoud van het onderwerp maar ook over het verkrijgen van agendastatus voor dit onderwerp.

Beleidsontwikkeling in dit onderzoek wordt gezien als het proces van het ontwerpen, overwegen, afwijzen en accepteren van opties of alternatieven voor een beleidsprobleem en het formuleren van deze alternatieven als een beleidsvoorstel. Het besluitvormingsproces wordt dus niet besproken. Binnen deze definitie zijn er een aantal theorieën van beleidsontwikkeling bekeken om variabelen te vinden die kunnen helpen in het onderzoeken van de invloed van het gebruik en de perceptie van GIS op de beleidsontwikkeling. Veel van deze theorieën zijn reacties op het rationele actormodel dat aanneemt dat mensen in staat zijn alle mogelijke alternatieven te bedenken, alle consequenties van deze alternatieven kunnen berekenen en tot slot het alternatief te kunnen kiezen dat het meest optimaal is. De eerste theorie die behandeld wordt, is het satisficing model. In dit model wordt aangenomen dat mensen niet de mate van rationaliteit aan de dag kunnen leggen die het rationele actor model veronderstelt. Mensen zijn beperkt in de mate van rationaliteit en daarom, samen met het feit dat tijd en middelen beperkt zijn, zullen actoren altijd kiezen voor een suboptimale oplossing, zolang deze naar tevredenheid is. Een tweede theorie die behandeld wordt, is successive limited comparisons, ook hier wordt aangenomen dat mensen beperkt zijn in de mate van rationaliteit die ze aan de dag kunnen leggen. Daarbij wordt gesteld dat actoren alternatieven zouden moeten kiezen die niet in hoge mate verschillen van de bestaande situatie zodat radicale verandering niet plaatsvindt. Radicale verandering zou voor onvoorziene consequenties kunnen zorgen. Een derde theorie die besproken wordt, is mixed scanning. Dit is een mix tussen het rationele actor model en successive limited comparisons. De theorie schrijft voor eerst alle mogelijke alternatieven globaal te bekijken en later in detail te kijken naar die alternatieven die in de globale scan geschikt leken. Het normative optimum model is ook een reactie op het rationele actor model en successive limited comparisons. Dit model erkent de beperking in rationaliteit maar voegt extra rationele componenten toe. Tot slot is het institutional analysis and development framework behandeld. Hier wordt ervan uitgegaan dat actoren over een beleidsvoorstel onderhandelen in een actiearena en hun acties worden beperkt of geholpen door cultuur, rules in use en kenmerken van de fysieke wereld.

Hierboven is beschreven welke definities gebruikt worden voor agendavorming en beleidsontwikkeling en het is besproken wat GIS is vanuit een rationalistisch uitgangspunt maar ook vanuit een epistemologisch uitgangspunt. De volgende stap om de hoofdvraag te beantwoorden is het construeren van een conceptueel raamwerk waarmee de case studies geanalyseerd kunnen worden. Een positie in het technologie debat is al gekozen, nu is het belangrijk een epistemologische positie te kiezen die gebruikt kan worden om niet alleen naar technologie te kijken maar naar de realiteit in zijn geheel. In het onderzoek wordt beargumenteerd dat sociaal constructivisme de meest passende positie is binnen dit onderzoek. De kern van de theorie van sociaal constructivisme is het idee dat alles in de realiteit gevormd is door mensen, alles is een sociaal construct. Dit kan bezien worden in de functie: X telt als Y in context C. Daarbij is het zo dat nadat instituties gevormd zijn, deze binnen de betekenis die ze gekregen hebben de samenleving beïnvloeden. Dat betekent dat technologie, GIS, de samenleving en mensen, evenals processen van agendavorming en beleidsontwikkeling in dit onderzoek bezien zullen worden vanuit een sociaal constructivistische invalshoek.

Nu moeten de concepten van sociaal constructivisme, sociale constructie van technologie en de theorieën van agendavorming en beleidsontwikkeling samenkomen tot een conceptueel raamwerk. De kern van het conceptuele raamwerk voor agendavorming kan samengevat worden door te stellen dat er een policy sub-system bestaat waarin interactie beïnvloed wordt door formele instituties, de vorm van het onderwerp en het policy window. Ook wordt het policy sub-system beïnvloed door technologie, die, nadat die gevormd is door actoren, de acties in de policy sub-system kan helpen en beperken via de technologische frames die verschillende groepen actoren hebben. Wanneer de technologie eenmaal gevormd is, zal deze ook de structuur beïnvloeden. In het policy sub-system opereren verschillende groepen die hun waarden vooruit proberen te duwen, deze waarden kunnen conflicteren met de waarden van anderen. Door deze waarden voorwaarts te duwen proberen actoren hun geprefereerde onderwerp op de agenda te krijgen. Zij doen dit binnen hun technologisch frame en met hun relatieve macht. Uiteindelijk zal een consensus ontstaan en er zal een alternatief gekozen worden dat zal dienen als het alternatief dat agenda status zal bereiken.

Het conceptuele raamwerk voor beleidsontwikkeling zal voor een groot gedeelte hetzelfde inhouden. Dat betekent dat er een actiearena is waarin interactie beïnvloed wordt door formele instituties, rules in use en cultuur. De actie arena wordt ook beïnvloed door technologie die, nadat deze gevormd is, de acties in de actie arena kan helpen en beperken door de technologische frames die actoren hebben. De technologie zal ook de structuur beïnvloeden. In de actie arena proberen verschillende groepen hun waarden vooruit te duwen, die kunnen conflicteren met de waarden van anderen, om tot een beleidsvoorstel te komen dat past bij hun waarden. Dit doen deze actoren binnen hun technologisch frame en met hun relatieve macht. Alle actoren in de actiearena zijn beperkt in de mate van rationaliteit die ze aan de dag kunnen leggen. Ze zullen mikken op een oplossing die naar tevredenheid in plaats van optimaal is, dit omdat tijd en middelen beperkt zijn alsmede hun rationaliteit. Uiteindelijk zal er een consensus ontstaan en zal er een alternatief gekozen worden als beleidsvoorstel.

De conceptuele raamwerken zullen gebruikt worden om de case studies te analyseren. In dit onderzoek is gekozen om verschillende onderzoeksmethoden te combineren, dit heet methodologische triangulatie. Deze methode houdt in dat de sterke punten van verschillende theorieën gecombineerd kunnen worden waarbij ze tegelijkertijd elkaars zwakke punten neutraliseren. De combinatie van deze methoden zal bestaan uit, in de eerste plaats het onderzoeken van bestaand materiaal. Een tweede methode die gebruikt wordt is case studie research; zes casestudies zijn uitgevoerd. Dit zorgt ervoor dat het empirisch bewijs direct geobserveerd kan worden. Het materiaal in de casestudies bestaat uit drie delen. Eerst is al bestaande informatie onderzocht, zoals wettelijk documenten, rapportages, beleidsdocumenten en nieuwsberichten. Ten tweede zijn er semigestructureerde interviews gehouden met stakeholders om ervoor te zorgen dat hun perceptie van het onderwerp en van andere actoren onderzocht kan worden. Tot slot is er geobserveerd. Interactie tussen actoren is bekeken en met de GIS applicatie in elke case studie is gewerkt. Het moet opgemerkt worden dat de zes casestudies gebruikt zullen worden om tot een analytische generalisatie te komen van de invloed van de perceptie en het gebruik van GIS op agendavorming en beleidsontwikkeling. Het selecteren van de casestudies is gedaan volgens een aantal criteria. Het eerste criterium is dat de GIS applicatie nieuw in de sector moet zijn, het innovatieve karakter is dus hoog. Een tweede criterium kan gevonden worden in de beleidscyclus. Omdat dit onderzoek zowel agendavorming als beleidsontwikkeling behandeld, is het belangrijk de case studies te verdelen. Drie case studies zijn uitgevoerd in het veld van agendavorming en drie andere in het veld van beleidsontwikkeling. Het derde selectie criterium heeft te maken met de beleidssector. Alle casestudies zijn in een andere sector van beleid uitgevoerd. Dit is belangrijk omdat het onderzoek een exploratief karakter heeft als het gaat om het verklaren van de invloed van de perceptie en het gebruik van GIS op agendavorming en beleidsontwikkeling in het algemeen, dus niet in een specifieke beleidssector. Een vierde criterium is de bestuurslaag. Het is belangrijk om niet alleen op nationaal niveau te kijken om de invloed van de perceptie en het gebruik van GIS op agenda vorming en beleidsvorming te kunnen verklaren . Twee casestudies zijn uitgevoerd op lokaal niveau, twee op provinciaal niveau en twee op nationaal niveau.

De eerste casestudie behandelt HIS en FLIWAS, beide zijn GIS applicaties die gebruikt worden om waterniveaus te monitoren in Nederland en Duitsland. De applicatie wordt ook gebruikt om overstromingen te voorspellen en de consequenties hiervan te berekenen in termen van economische schade, slachtoffers en evacuatieroutes.

De tweede casestudie die uitgevoerd is, is de casus van de risicokaart. Dit is een GIS applicatie die door de Nederlandse overheid gebruikt wordt om burgers te informeren over risico's in hun omgeving. Deze risico's zijn onder andere de opslag van gevaarlijke stoffen en potentieel gevaarlijke industrieën.

De derde casestudie die wordt behandeld in het veld van agendavorming is de casus TSN. Hier wordt een GIS applicatie door de Duitse overheid gebruikt om inzicht te verkrijgen in besmettelijke veeziekten. De applicatie kan de consequenties van een uitbraak berekenen maar ook het effect van preventiemaatregelen.

De eerste casus die uitgevoerd is in het veld van beleidsontwikkeling is Virtuocity in twee steden. Virtuocity is een GIS applicatie die door de Nederlandse steden Tilburg en Helmond gebruikt wordt. De applicatie laat bouwplannen voor de stadscentra zien op driedimensionale wijze. Zo kunnen burgers hun stad bekijken, hun mening geven en in sommige gevallen voor of tegen plannen stemmen.

De vijfde casestudie die wordt behandeld is de casus fijnstof. Bij dit onderwerp wordt een GIS applicatie door de Nederlandse overheid gebruikt om concentraties van fijn stof te meten. Dit kan een meting op elk bepaald moment zijn maar het kan ook een berekening zijn van het effect van bouwplannen. Een bouwplan kan gestopt worden op basis van deze meting.

De laatste uitgevoerde case studie is Congestion Charging. Hier wordt een GIS applicatie gebruikt in Londen. De applicatie is in staat file te monitoren maar kan ook consequenties berekenen van maatregelen om file te verminderen.

Nadat het empirische materiaal besproken is, kunnen er conclusies getrokken worden en kan er een antwoord op de hoofdvraag gevonden worden.

Omdat de hoofdvraag in twee delen verdeeld kan worden, namelijk de invloed van de perceptie en het gebruik van GIS op agendavorming en op beleidsvorming, zullen de conclusies ook zo beschreven worden.

Een eerste conclusie in het veld van agendavorming heeft te maken met completering van de betekenis van technologie. In andere woorden, hebben alle actoren dezelfde perceptie van de technologie. Empirie laat ons zien dat de completering van de betekenis afhankelijk is van het doel van de technologie. Een applicatie die actie eist zal veel minder snel gecompleteerd worden dan een applicatie die slechts voor communicatie gebruikt wordt.

Daarnaast zal een applicatie met een groot bereik en veel functionaliteiten minder snel gecompleteerd worden dan een simpelere applicatie. Het onderwerp zelf is ook belangrijk, een sterk gepolitiseerd onderwerp zal minder snel gecompleteerd worden. De mate van completering van de betekenis van technologie beïnvloedt het proces van agendavorming.

De tweede conclusie heeft te maken met macht. Wanneer GIS gebruikt wordt in het veld van agendavorming laat de empirie zien dat machtsrelaties tussen actoren kunnen veranderen. Actoren zonder macht kunnen meer macht verkrijgen en actoren met macht kunnen macht verliezen. Dit kan verklaard worden via het idee dat door het gebruik van GIS nieuwe informatie zichtbaar wordt door de functies van integratie, calculatie en visualisatie. De actoren met toegang tot de informatie worden machtiger dan de actoren zonder toegang. Het is niet alleen de data die hen deze macht geeft, maar ook de applicatie. De ruwe data alleen is niet genoeg voor deze machtsverschuiving, maar het is de applicatie die calculatie, simulatie en scenario schetsen mogelijk maakt. Dit betekent dat de 'war on data' zoals dat decennia geleden genoemd werd, niet meer toepasbaar is omdat de applicatie zelf belangrijker wordt. De zichtbare machtsverschuiving is meestal een verschuiving van macht naar experts en technici; zij gebruiken GIS om hun ideeën te communiceren naar beleidsmakers en het publiek op een manier die begrijpelijk is. Ook kunnen zij consequenties van alternatieven visualiseren. Daarnaast kunnen organisaties door standaardisatie zich organiseren tot een machtsblok. Ook het publiek kan meer macht verkrijgen in het geval de GIS applicatie ontworpen is om hen te informeren. Het moet hier wel opgemerkt worden dat deze machtsverschuiving niet een absolute verschuiving is, maar alleen bestaat in de perceptie van actoren.

Een derde conclusie die getrokken moet worden, kan gerelateerd worden aan de tweede conclusie. Ook al zijn machtsrelaties veranderd door de perceptie van GIS, dit mag niet zomaar gezien worden als een willekeurig proces. Empirische data laat zien dat het afhankelijk is van de initiator van de applicatie wie meer macht krijgt. Wanneer de GIS applicatie geïnitieerd wordt door de overheid zal de applicatie ook de overheid machtiger maken. Maar wanneer dit niet het geval is en de applicatie wordt geïnitieerd door een andere partij dan zal deze partij meer macht verkrijgen. Het moet wel gezegd worden dat een partij anders dan de overheid minder extra macht verkrijgt dan wanneer de overheid de initiërende partij is. Dit kan verklaard worden door de formele wetgeving die de overheid kan instellen op het moment van initiatie. Dit maakt discussie onmogelijk, andere actoren hebben deze macht niet.

De vierde conclusie heeft geen betrekking op macht maar op de GIS applicatie zelf. Agendavorming heeft te maken met het vooruit duwen van nieuwe ideeën, nieuwe problemen en nieuwe standpunten met het doel hen tot agendapunt te maken. GIS kan een mogelijkheid bieden dit te doen. In elke casestudie is het zo dat de GIS applicatie het openen van een policy window veroorzaakt. Door het integreren van verschillende datasets, het calculeren van consequenties en het visualiseren van effecten kan GIS ervoor zorgen dat vele actoren nieuwe ideeën begrijpen. Hierdoor kunnen nieuwe standpunten ingenomen worden, nieuwe problemen ontstaan en nieuwe oplossingen worden gegenereerd. Deze nieuwe oplossingen worden niet alleen door experts gezien maar ook door beleidsmakers en het publiek. Dit veroorzaakt het openen van een policy window. Het implementeren van een GIS applicatie veroorzaakt dus het openen van een policy window waardoor nieuwe ideeën naar voren geschoven kunnen worden die door de applicatie zelf gegenereerd zijn.

Wanneer we kijken naar de conclusies betreffende de invloed van de perceptie en het gebruik van GIS op het verloop, de inhoud en de uitkomst van beleidsontwikkeling zien we dat de conclusies voor een groot gedeelte gelijk zijn aan die van agendavorming. Toch kunnen er ook verschillen gevonden worden.

Net als voor agendavorming heeft de eerste conclusie te maken met de completering van de betekenis van technologie. Net als bij agendavorming hangt deze completering af van het bereik van de applicatie, het doel van de applicatie en de mate van politisering van het onderwerp. Maar er is nog een andere factor die bij beleidsontwikkeling naar voren komt, namelijk de vraag wie toegang heeft tot de data en de applicatie. Als er slechts een actor toegang heeft tot de applicatie dan gebruikt deze actor de applicatie voor zijn ideeën. Als er meerdere actoren toegang hebben, is dat niet meer mogelijk en dan kan niemand de applicatie enkel voor zijn eigen belang gebruiken. Het verschaffen van toegang aan meerdere actoren verhoogt daarmee de kans tot completering van de betekenis van technologie.

Een tweede conclusie is ook gelijk aan die van agendavorming. In het proces van beleidsvorming is het eveneens zo dat door het gebruik van GIS machtsrelaties kunnen verschuiven. De actoren met toegang tot de data en de applicatie verkrijgen meer macht. Zij beslissen welke calculaties er gemaakt worden en welke informatie gedeeld en getoond wordt. Zij beschouwen de GIS applicatie als een machtsmiddel en gedragen zich ook zo. Actoren die de applicatie als bedreigend beschouwen zullen zich hier ook naar gedragen.

De derde conclusie correspondeert ook met de conclusies in het veld van agendavorming. Binnen processen van beleidsvorming is het eveneens belangrijk wie de GIS applicatie heeft geïnitieerd. De initiërende actor zal ervoor zorgen dat de applicatie zijn belangen dient. Wanneer dit de overheid is dan wordt dit nog verder versterkt doordat de overheid in staat is de mogelijkheden van de applicatie vast te leggen in de wet waardoor discussie onmogelijk wordt.

Naast conclusies die corresponderen met de conclusies in het veld van agendavorming zijn er ook conclusies te vinden die dat niet doen. In de eerste plaats is het zo dat door het gebruik van GIS de rationaliteit stijgt. Omdat GIS grote hoeveelheden data kan calculeren en dit kan presenteren op dusdanige wijze dat veel mensen dit begrijpen, omdat simulaties gemaakt kunnen worden en omdat effecten getoond kunnen worden, wordt het mogelijk beleid op een rationelere manier te ontwikkelen. Voor beleidsontwikkeling betekent dit dat actoren beter instaat zijn om met elkaar te communiceren, door de integratie- en communicatiefuncties van GIS. Door verbeterde transparantie, calculatie, simulaties en de nieuw gegenereerde informatie verandert het proces van beleidsontwikkeling. Nieuwe standpunten kunnen naar voren komen en nieuwe mogelijkheden worden gezien. De uitkomst van het beleidsontwikkelingsproces wordt dan niet alleen rationeler maar kan ook verantwoord worden door simulaties en verbeterde berekeningen.

Een andere conclusie die getrokken kan worden, is dat ook cultuur en rules in use beleidsontwikkeling beïnvloeden. Het gebruik van GIS kan bestaande rules in use en de bestaande cultuur beïnvloeden. In de eerste plaats zien we een rule in use waarin nominale getallen als betrouwbaar worden gezien. Daar berekeningen door GIS gebaseerd zijn op nominale getallen zou het lijken alsof de GIS applicatie betrouwbaar is, maar dit is niet altijd het geval. Door grote onzekerheidsmarges in deze calculaties en formules kan het zo zijn dat de uitkomst niet als legitiem gezien wordt en als dienend voor een actors eigen belang. Dit laat zien dat de GIS calculaties niet alleen kunnen zorgen voor een rationeler beleidsvoorstel maar ook voor meer conflict. Voor het proces van beleidsontwikkeling betekent dit dat het conflict betreffende de betrouwbaarheid van de applicatie kan ontstaan.

Deze conclusies beantwoorden de hoofdvraag nog niet volledig. In de empirische werkelijkheid is gevonden dat naast de agendavormingsarena en de beleidsontwikkelingsarena er nog een andere arena ontstaat door het gebruik van GIS. Dit is de arena waarin de GIS applicatie ontworpen wordt. Het feit dat deze arena tegelijkertijd ontstaat met de arena over een specifiek onderwerp is een conclusie. Hierdoor kan gesteld worden dat wanneer technologie, een specifieke, complexe en multifunctionele technologie als GIS, geïmplementeerd wordt een tweede arena ontstaat waarin beleid ontworpen moet worden betreffende het ontwerp van de applicatie. In sommige situaties vinden de acties in de eerste arena (agendavorming en beleidsontwikkeling) tegelijkertijd plaats met de acties in de tweede arena van het ontwerpen van de applicatie. In andere gevallen vinden de acties in de tweede arena plaats voordat de eerste ontstaat. Het is belangrijk dat in de arena waarin de GIS applicatie ontworpen wordt een groot deel van de basis wordt gelegd van de completering van de betekenis van de technologie. De initiator van de applicatie, degene die toegang tot de data en de applicatie heeft, het bereik en het doel van de applicatie bepalen de mate van completering van de betekenis van de technologie. Ook de machtsrelaties in agendavorming en beleidsontwikkelingsprocessen bepalen dit. Het is de tweede arena waarin deze zaken bepaald worden. Daarom is het belangrijk wanneer we processen van agendavorming en beleidsontwikkelingen bij het gebruik van GIS willen gebruiken dat de tweede arena begrepen, erkend en behandeld wordt.

Wanneer we in deze arena kijken kunnen we een aantal conclusies trekken. Net als bij de andere twee arena's is het belangrijk te kijken naar de completering van de betekenis van technologie. Het is belangrijk dat de bepalende factoren voor de mate van completering in deze arena bepaald worden. De uitkomsten van het beleid betreffende het ontwerpen van de GIS applicatie beïnvloeden de arena's van agendavorming en beleidsontwikkeling.

Een tweede conclusie in deze arena is dezelfde als in de andere arena's, ook al wordt in deze arena de applicatie ontworpen, toch zien we een machtsverschuiving. De actoren met toegang tot de data en de applicatie worden machtiger en gedragen zich als zodanig. Ze beschouwen de GIS applicatie als van toegevoegde waarde voor hun belangen. De initiators van de applicatie beslissen meestal wie toegang tot de applicatie heeft en verschaffen zichzelf over het algemeen ook toegang. Om deze reden profiteren zij op twee manieren, zij zijn degene met toegang en bepalen het doel van de applicatie waarbij ze zorgen dat de applicatie hun belangen dient. Dit lijkt gelijk aan de conclusies in de andere arena's maar in deze arena kan meer conflict gevonden worden. Omdat in deze arena het nog niet vastgelegd is wie toegang zal krijgen en voor welk doel de applicatie gebruikt wordt, bestaat er meer ruimte voor conflict. Alle actoren wensen dat de applicatie hun meer macht verschaft.

De derde conclusie in deze arena is eveneens gelijk aan de conclusies boven beschreven. Namelijk dat de initiator van de GIS applicatie veel macht houdt omdat hij beslist wat de applicatie kan en zal doen. Ook is het hier zo dat als de overheid de initiator is, deze macht nog versterkt wordt doordat de overheid zaken bij wet kan vast leggen. Wat verschilt van de andere arena's is dat wanneer de initiator niet de overheid is, de initiator sterk gehinderd kan worden door formele instituties omdat organisaties erg gefragmenteerd zijn.

Ten vierde moet in deze arena goed gekeken worden naar rationaliteit. In de vorige arena zagen we dat beleidsontwikkeling rationeler werd door GIS, in deze arena gebeurt het tegenovergestelde. De reden hiervoor is dat in deze arena geen calculaties of simulaties gemaakt worden, er is niets om te visualiseren. In deze arena hebben actoren te maken met een nieuwe applicatie die vaak nog niet doorontwikkeld is. Wat de consequenties van deze applicatie zullen zijn, economisch, sociaal en politiek, is volledig onbekend omdat er geen precedent is. Wat dit betekent voor beleidsontwikkeling in deze arena is dat het hele proces gekarakteriseerd wordt door een situatie van risicomijdend gedrag. Sommige functionaliteiten van GIS worden niet geïmplementeerd, sommige actoren krijgen geen toegang, het bereik van de applicatie wordt beperkt en zo verder. De inhoud van het proces wordt op deze wijze ook beïnvloed omdat actoren de consequenties van de implementatie van de applicatie vrezen, zij zijn voorzichtig met het toevoegen van functionaliteiten. Daarnaast moeten zij deze functionaliteiten afwegen tegen zaken als verantwoordelijkheid, onzekerheid van calculaties, het uitsluiten van groepen en de kosten van de technologie.

Een vijfde conclusie laat zien dat satisficing, het vinden van een oplossing die naar tevredenheid is in plaats van optimaal, in de vorige arena niet sterk aanwezig was. In deze arena is dit concept wel sterk aanwezig. Er wordt vaak voor een suboptimale oplossing gekozen. Dit heeft meestal te maken met risicomijdend gedrag, integratie die niet altijd waargemaakt kan worden, angst om autonomie te verliezen, het verliezen van de balans volledige informatie en begrijpbaarheid en doordat tijd en middelen vaak niet toereikend zijn.

Een laatste conclusie heeft te maken met cultuur. De heersende cultuur bepaalt vaak hoe GIS applicaties gezien en gecommuniceerd worden. Naast een cultuur van risicomijdend gedrag zien we ook een cultuur van de overheid om alle zaken in eigen handen te houden en niets uit handen te geven Op deze manier wordt conflict in deze arena verminderd, alles ligt immers al vast bij wet.

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