

Mastering Environmental Resources Management

Essays from IVM Master's students

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R-05/04

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Introduction

In 1972, the Dutch government published its 'Emergency Note on Environmental Health', one of many policy documents on environmental problems that appeared at that time around the globe. The document detailed how pollution issues, which were said to be affecting human health, were to be dealt with. The note predicted that with adequate technological measures, existing pollution problems would be solved and the creation of new problems prevented.

Now, 33 years later and with hindsight we could easily smile at the optimism of the early days. Rather than being solved, the domain of environmental problems has continuously grown. No longer are we just focused on pollution, we now also deal with climate change, water shortages and floods, issues related to genetically modified organisms, and a various array of risks. These risks are so typical for our era that some have labeled our current society the 'Risk Society'. This points to a second observation, which is that we have become aware of how interwoven environmental problems are in the fabric of our societies. In that sense, the quick and technical fix envisioned in the 1970s is a song line of the past.

Environmental issues are not merely an unintended byproduct of our societies' organization, they are deeply embedded in the way we lead our lives, how we relate to each other and how our institutions (communities, markets, states and international organizations) operate. Environmental risks may not arise intentionally at all times, they do not arise free of biases either. There are power relations and social perceptions at work, also in the realm of the natural sciences, that determine whether or not certain conditions will become known, defined as problems or not, and whether or not they will be subject to attempts –either from the public or private sector, or a combination (governance)- to improve the situation.

It is obvious that the realization of how environmental problems have changed requires a different approach of those who want to contribute to their solution. First of all, environmental solutions require an inter-, multi- or even transdisciplinary approach. Second, there must be extensive attention to the societal component. Many environmental problems are easy to solve from a technological point of view, yet they are not brought to closure. Third, one must pay extensive attention to the issue of scale. Scale relates to the temporal and spatial dimension of both environmental problems and the institutions put in place to combat them. Without losing track of the relations between scale, one must therefore be able to analyze problems at the national scale, but probably more importantly also at the local and global scales.

It is fortunate that at times when interest in environmental issues appears to be waning in comparison to the atmosphere 25 years ago, there are still many people that wish to play an active role in addressing modern environmental problems and dilemmas. Each year, students from around the world join the Masters' Programme on Environment and Resource Management (ERM) at the Vrije Universiteit Amsterdam. This year's class was about 50 people strong and consisted of highly motivated individuals, ready to better the world by becoming specialists in environmental solutions. The structure of the ERM program is such that after a general introduction ('Module 1') and a case study that re-

lates the intrinsic complexities of environmental issues ('Module 2'), the students move on to learn about methods such as Cost Benefit Analysis ('Module 3') and finally about environmental policy, economics and management ('Module 4'). After this, the students are required to do an internship ('Module 5') and they close the programme by reflecting upon their own development during the year ('Module 6').

The report before you is the first of its kind. It was edited by three particularly active and gifted students of the 2004-2005 class: Ann Holleman from the USA, Viviana Lujan from Costa Rica, and Eric Massey from the USA. When asked which students wanted to develop a report that contained the best student papers written in Modules 3 and 4, they stepped forward and volunteered. Together they skimmed through the available papers (the ones that were graded very good or excellent by supervising teachers), developed themes to structure the book, and edited the selected papers. All three of them did an excellent job.

The reader may wonder why this report was made in the first place. This report does not have the consistency of a book because not all contributions are on a common theme. Neither are the authors (yet) top academicians in the field of environmental sciences. In that sense, the pretense is not that great. The purpose is rather to allow the students to share their work and findings with a larger audience and to give prospective or potential ERM students a point of orientation on the work that they may do. Finally, the contributions in this report are excellent in their category. Most of them show the great potential the authors have as researchers, in that they contain interesting findings and conclusions. Specialist readers may turn to the chapters that are in their field and actually find new and fresh contributions to the topics they are working on themselves. It is in this, that we as teachers are very proud of all the authors included here.

We have chosen to divide this report into four chapters, which reflect the range of topics covered in the ERM programme: *Stakeholders & Policy*, *Resource Conflicts*, *Economic Instruments*, and *Industry & Transformation*. Each chapter contains three student papers, each of which broadly touches upon and addresses in their own unique manner the themes of the chapters.

Chapter 1: Stakeholders & Policy

The participation of parties outside of government actively taking a role in the design, development and execution of environmental policies has been one of the constant planks of thought in modern environmental management as it ensued since the late 1960s. As governments seek measures to combat pollution, foster economic development, or allocate rights over natural resources, individuals and industries who are affected by such measures have been asking and in some cases demanding, that their voices and opinions be heard. They argue that since it is they who are affected by government policies they have a right to be at the decision table. Who then governments choose to include or exclude from the policy making process and finding compromises between differing opinions has significant ramifications on the legitimacy and efficacy of any new environmental policies.

In this chapter, the first paper addresses whether farmers should have a seat at the decision table for the Grensmaas project in the Netherlands and whether agrarian nature management should have a larger role in environmental management. In the second pa-

per, the author uses spatial and stakeholder analysis as a framework for discussing policy options in the Kresna gorge of Bulgaria, where conflicts arose among stakeholders over a highway expansion project in an area valued for its biodiversity. The third paper argues that indigenous peoples have unique relationships with the environment and that these relationships are adversely affected by policies on international trade and foreign investment. The authors illustrate their argument with two case studies and make recommendations on how indigenous peoples can be better represented in international trade agreements.

Chapter 2: Resource conflicts

Despite the fact that the modern environmental movement began over issues of pollution control, conflicts over the rights and use of natural resources is probably one of the oldest environmental issues. Who has the right to use what, how and how much, form to a certain degree, the foundations of environmental management. In most countries, property rights use to be private. Landowners could lay claim to the forest, water and soil on their lands. Infringements on the enjoyment of this property, e.g. by pollution could be brought before the courts, which could award compensation. In many countries, this situation ended in the early 20th century, with governments taking public ownership of environmental resources. In most cases this was at least partly done to allow for industrialization, and the subsequent increased levels of pollution were to simply be accepted. One consequence is that nowadays governments are at the center of various resource conflicts and therefore management of conflict is an important element of policy and management.

This first paper in this chapter uses extended cost-benefit analysis to explore different policy options for changing Forest Practices Rules in Washington State, USA. Should the new rules give more consideration to nature conservation or to income generating activities such as timber logging? The second paper analyzes sustainable finance strategies of Marine Protected Areas in Indonesia, examining the need to ensure protection of the areas with the need for their economic stability through tourism activities. The final paper of this chapter looks at the Forest of the Lost Child in Kenya and weighs what decision making support tools can be used to resolve conflicts between local people and outside interests.

Chapter 3: Economic instruments

With the maturation of the environmental movement in the late 1980s and early 1990s and the resolution to many of the earlier pollution problems, governments began to feel a backlash from industries against what they saw as old and outdated regulatory policies. Industries felt that command-and-control left them with limited power to manage their businesses. Since the early 1970s, economists had been advocating the use of market-based instruments to address certain environmental issues, arguing that the invisible hand of the market was more efficient than the heavy hand of government. Pollution taxes, tradable permits and the privatization of public utilities were among the few tools and actions taken to realize the shift away from the more traditional regulatory measures.

In the first paper of this chapter the author argues for the use of a tax-and-subsidy scheme to address the problem of pollution emissions. The second paper aims to identify

how considerations of equity in the Kyoto protocol can affect the overall efficiency of the emissions trading scheme. The final paper looks at the appropriateness of the privatization of public utilities, such as water companies, by focusing on the case of the 2000 privatization of Sofia's water company in Bulgaria.

Chapter 4: Industry & Transformation

The increasing demand for energy and the increasing use of fossil fuels as a source of energy are fostering a debate at national and international levels on whether there will be enough sources of energy to meet that demand as well as what the ramifications of our dependency on fossil fuels will have on the state of the natural environment. A faction in this debate has called for the transformation of industry and society as a whole, lobbying for an entire restructuring of the energy paradigm. To be sure, not only must green house gas emission be reduced but also new alternative sources of energy must be found and developed rapidly, but what are the most effective means in achieving these goals?

The first paper in this section looks at proposed voluntary agreements and their shortcomings between the Government of Canada and the auto industry to increase fuel efficiency and reduce green house gas emissions. The second addresses the issue of China's rapidly expanding economy and the country's growing need for energy. Through voluntary agreements, can the Government of China and Chinese industries create effective policies to increase energy efficiency? The final paper analyzes Iceland's "front runner" status in the transition to a hydrogen economy and examines how the concept of systems innovation can be applied to such a transition, what the pros and cons are from such a transition and what lessons can be learned from Iceland's experience.

On behalf of the students and teachers of the ERM program at IVM, we hope you will enjoy this report.

Prof.dr. Jeroen van den Bergh and Dr. Dave Huitema (coordinators for Module 4 ERM program).

1. Stakeholders and policy

1.1 Framing the farmers out?

An exploration of agrarian nature management as an alternative outcome in the Grensmaas project, author Liesbeth Eshuis.

1.1.1 Introduction

Taking the Grensmaas project (see Section 1.1.2) in the Dutch province of Limburg as a case study in environmental management, it is striking that farmers – who will be considerably affected by the project – have hardly any influence on the outcome of the decision making process. The exclusion of this stakeholder group raises questions about public participation and about alternative solutions to reach the objectives of the project. For these reasons, the two research questions of this report will be: 1) How are farmers involved in the decision making process in the Grensmaas project? and 2) Should agrarian nature management have been taken into consideration as a possible solution for farmers in the Grensmaas area?

General basis of the research questions

The case study is situated around the Dutch portion of the Maas river.¹ The Maas is currently facing substantial changes as part of a project that will take shape over the next decade. This project, ‘the Maas of tomorrow’, is divided into two focal areas: the ‘Zandmaas/Maasroute’ and the ‘Grensmaas’. In this paper I will focus on the Grensmaas, which forms a section of the border between the Netherlands and Belgium. The aim of the project is to transform this stretch of the Maas into a nature area. The nature area will be part of a national ecological network that has to be finished in 2018. The plan for the network was introduced in 1990 by the federal government. When completed, it will reserve approximately 50,000 hectares (ha) of core natural habitats, which are inter-connected physically and functionally, to secure migratory routes for plants and animals and to maintain nature quality in the Netherlands (LNV, 2005). The nature area around the Grensmaas will comprise 2,000 hectares (ha) in total, with 1,200 ha on the Dutch side and 800 ha on the Belgium side (Projectbureau Grensmaas, 1994). Next to nature development, the goals of the Grensmaas project are a reduction of flood recurrence and gravel extraction.

In this case study, river management involves a variety of stakeholder interests. I will focus on the position of the agrarian stakeholder group in the Grensmaas area. Effects on this stakeholder group are clear, since most of the land designated for interventions is in agricultural use. The effect of the Grensmaas project for these farmers can differ from the sale of a strip of land alongside the river to a total loss of their land. In spite of this fact, the agricultural sector is not invited to co-operate as an official partner of the decision-making parties. These parties include the governmental organisation Maaswerken,

¹ In English this river is called ‘Meuse’, but since it is a Dutch case I will use Dutch topographic names.

several nature organisations, and the gravel extractors. In the farmers' opinion, an increase in agrarian nature management is seen as an alternative solution for selling the land and losing their livelihood.

In order to address the research questions, I will present an overview of the project in the second section (1.1.2), followed by a discussion on the specific situation of the farmers and their involvement in the third section (1.1.3). In Section 1.1.4 I will explore the possibilities of agrarian nature management, and then go on to answer the research questions in the concluding section 1.1.5.

1.1.2 The river Grensmaas and contemporary developments

As a transboundary river, the Maas starts in France, runs through Belgium and ends in the Netherlands near the city of Rotterdam. In the Dutch province of Limburg, between Smeermaas en Maasbracht, the river forms the border between the Netherlands and Belgium (see figure 1.1).² It is characterized by a declining slope of about 0.5 m/km, gravel subsoil and the absence of weirs over a length of 45 kilometers. This part of the Maas is free of shipping, because ships are diverted through the Juliana Channel (visible in Figure 1.2) from the weir at Borgharen to Maasbracht.

Due to channel normalisation between 1860 and 1890 and to ongoing gravel extraction, the river has been transformed from a wide, shallow, meandering river into a small and deep channel (Beukenkamp, 2002). The river has an irregular discharge rate with fluctuating water levels; it is mainly fed by rainwater and its subsoil has a low storage capacity. The amount of rainwater in the French and Wallonian part of the river basin determines the discharge volume. The amount of water that flows through it at Maastricht are approximately 230 m³/sec, averaging 450 m³/sec in winter and 75 m³/sec in summer, with the extreme dry possibility of 25 m³/sec (Sommen, 1997).

The Grensmaas project

Although the floods of the Maas in 1993 and 1995 play a role in the design of the Grensmaas project, the reduction of flood recurrence was not the only reason for its initiation. The origin of the project is linked to the gravel extraction industry, which has been dominated by economic considerations for many years. Due to pressure from the local population concerning deterioration of the landscape caused by the mining activities, the Ministry of Traffic, Public Works and Water Management and the province of Limburg signed an agreement limiting gravel extraction to 35 million tons from 1990 to 2015. Extraction had to take place in an environmentally sustainable way, aimed at the preservation of the variety of natural life in the region (Teisman, 1995). After 1991, more environmental concerns started to play a role, when popular interest in 'new nature' began to grow. The area offered considerable possibilities because of the absence of shipping and the existing natural values (Beukenkamp, 2002). A nature development

² This section of the Maas owes its name to this function: Grensmaas translates to 'Border Maas'.

plan was designed for further development of the Maasdal³. The floods of 1993 and 1995 prompted the incorporation of safety issue into the plan (Teisman, 1995).

In 1997, the Grensmaas project was initiated to achieve two main goals:

1. Reduction of flood recurrence to 1/250 per year.
This means: bringing the flood risk down to 1/250 per year, or 0.4 %, according to probability calculations. In such an event the Maas will discharge 3,275 m³ of water per second.
2. Development of a minimum of 1,000 ha of riparian nature, in combination with ecological recovery of the river (Maaswerken, 1997)

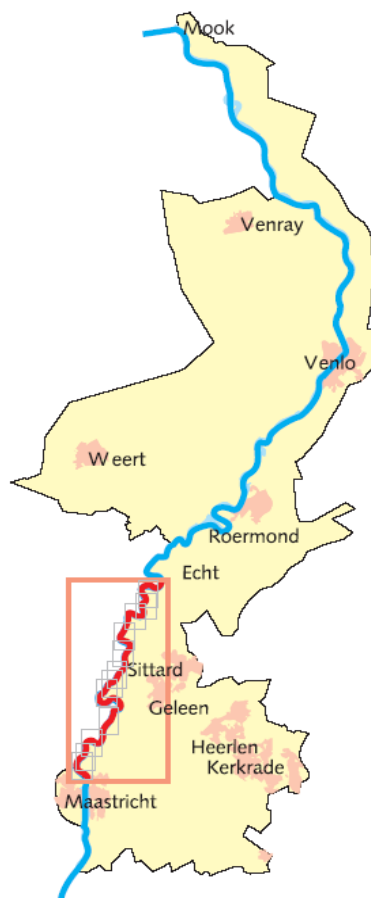


Figure 1.1 Location of the Grensmaas in the Dutch province of Limburg.

Source: Maaswerken (2005)

The goals of the project are to be achieved through a combination of land alterations: deepening and widening the summer bed, lowering the flood plains and side gullies, creating additional flood channels, and upgrading the adjacent navigation infrastructure. The Grensmaas project is divided into 12 locations, or sub-projects (see Figure 1.1) (Maaswerken, 2005).

³ Maasdal translates to 'Maas valley'.

An important aspect of the Grensmaas project is that it must be executed in a budget-neutral way. This means the goals of the project have to be achieved by way of public-private co-operation, and that the project must be funded by the proceeds of the 35 million tons of gravel that will be extracted for national use (Maaswerken, 2000).

Because it calls for a large scale, long-term plan that is based on multiple plans and that occurs within a complicated legal framework (for example Landinrichtingswet and Deltatwet rivieren, see Teisman, 1995), with different levels of decision making, and with multiple goals carrying different implications on various scales, the Grensmaas project can be seen as a river management project with a high degree of complexity. In addition to this, the case is further complicated by a variety of stakeholder interests.

In this paper I draw attention to the agrarian stakeholder group. Farmers are mainly concerned with land use changes and the impact of fluctuating groundwater levels on the arable land (Krywkow et. al, 2004). Before concentrating on the farmers, I briefly introduce the other stakeholder groups and their main interests. All stakeholders are described as organisations or institutions rather than individuals. Any internal contradictory views are omitted for the sake of clarifying the distinctions between the groups.

The other stakeholders

- The national decision maker
The national government is the main planner and decision maker. The main interest of the government is the realisation of nature development and gravel extraction in such a way that more than 3,000 m³ water per second can be discharged without causing overflow of the river. Specifically, the Department for Transport, Public Works and Water Management takes responsibility for the safety and the infrastructure of the area. In addition to policymakers, experts form a part of the government.
- The provincial decision maker
The provincial decision maker consists of policy makers and experts associated with the Province of Limburg. The impact and responsibility of this actor is restricted to the provincial scale. In general, the interests of this stakeholder correspond to the interests of the government. The Ministry of Transport, Public Works and Water Management, the Province of Limburg, and the Ministry of Agriculture, Nature and Food Quality set up a joint office in 1997 to oversee the project. This office is called Rijkswaterstaat Maaswerken and it is part of the Directorate-General of Public Works and Water Management (Maaswerken, 2004b).⁴
- Nature organisations
The nature organizations have special interests in the development of natural areas alongside the river. The most important organisations are Staatsbosbeheer, Natuurmonumenten, Stichting Ark and Stichting het Limburgs Landschap.
- Municipalities
The involved municipalities have a strong interest in an efficient and reliable system of flood protection. Additionally, they support the concept of nature development to enhance the recreational values of urban surroundings. About twenty municipalities

⁴ The Directorate-General of Public Works and Water Management is linked to the Ministry of Transport, Public Works and Water Management.

- cooperate in an association concerned with the planning procedures of the Maaswerken organisation.
- Gravel extractors
This stakeholder group is basically concerned with the cost-benefit relationships of gravel extraction.
- Citizen groups
Citizens groups' interests are particularly focused on disamenity issues. Participation is primarily based on preventing local inconveniences of planned measures, such as noise, vibrations and dust. To improve their impact on the planning procedure, part of this group is unified in BOM (Bewoners Overleg Maasvallei), which represents smaller local groups of stakeholders.

1.1.3 The farmer's voice

In their article, Valkering *et al.* (2004) show that there is extensive mutual agreement among policy-makers, citizens and nature organisations. In contrast, the farmers' group strongly objects to the plans concerning the Grensmaas. This is not surprising considering the fact that this group will be affected by the expected loss of land and a change in groundwater level. For the farmers, the disagreement is related to conflicting goals. Their interest in agricultural land and groundwater conditions inherently conflict with the approach of river widening and nature development. In this section I first summarize the farmers' situation in the area. This is followed by an analysis of the involvement of stakeholders in the decision making process and the involvement of farmers in particular. I argue that the involvement of farmers may have been inadequate.

Restructuring the land: agricultural consequences

The first Environmental Impact Assessment (EIA) concerning the Grensmaas project was completed in 1997. This EIA identified agriculture as one of the socio-economic functions in the area that will experience negative impacts as a result of the project (Sommen, 1997). After some aspects of the plan had been changed, a new EIA was conducted in 2003 (Maaswerken, 2003). An overview of the agrarian situation based on background research for the second EIA⁵ is given below.

The total surface of the Grensmaas area is 3,316 ha:

- Agriculture: 2,374 ha, of which 28 ha orchard, 1,075 ha arable farming and 1,271 ha grassland
- Buildings and infrastructure: circa 597 ha
- Nature: circa 263 ha
- Water: circa 81 ha

Regarding agrarian companies, a distinction has been made between farmers with built capital (structures) inside the area of the Grensmaas (55 companies) and farmers which own only land in the area (60 companies). Dairy farming is the biggest and strongest sector in the area, with an average of 75 cows per company in Limburg, compared to the national average of 45 cows per company. Arable farming is the second sector in size, however it is weaker, with an average size of 38 NGE (standardized norm to calculate

⁵ Conducted by a consultancy firm, Area Projecten.

the balance per crop or animal) in Limburg compared to national average of 67 NGE. Employers on arable farms are older on average than on dairy farms and often these companies have more difficulty finding a successor. The parcel structure in the area is unfavourable and complex. The majority of entrepreneurs have many small free parcels, with an average of 20 parcels per company on average 1.6 ha per parcel.

Table 1.1 Percentage of land that will be affected by the Grensmaas project per inventoried company.

% of land in area	Number of companies of intervention
<10 %	6
10-20 %	7
20-30 %	1
30-40 %	4
40-50 %	7
50-60 %	6
60-70 %	1
70-80 %	1
80-90 %	0
90-100 %	2

Source: Area Projecten (2003)

Forty-three companies with built capital inside the area of the Grensmaas (see Figure 1.2), who account for 1035 ha in total, co-operated in the background research. Thirty-five of these companies will be affected by the Grensmaas project (see Table 1.1). In total, 40 to 50% of the land that will be affected is in use by these companies. It should be mentioned that these numbers are based on the effects of the preferred alternative, which will most likely be the final alternative.

Table 1.2 Percentage of land in use in the area of the Grensmaas project of the 42 responding companies

% of land in area	Number of companies of the Grensmaas
<25 %	25
25-50 %	3
50-75 %	3
75-100 %	11

Source: Area Projecten (2003)

Of the sixty companies who own land in the area but do not have built capital in the area, forty-two co-operated in the research (see Table 1.2). They are responsible for 310 hectares in the Grensmaas. At the time of the research, the effect of the planned interventions on their parcels was unknown (Area Projecten, 2003).

With the completion of the preferred alternative, a total of 1,385 ha of agriculture will be lost in the area (Sommen, 1997).

The above information gives an impression of the position of the farmers in the region. Next to this impact, there is a demand for change in the adjacent cultivated landscape (Maaswerken, 1997). The land surrounding the core nature area will have to be farmed less intensively, to serve as a buffer zone between conventional agriculture and the

Grensmaas nature area. The farmers who own this land can apply for subsidies (see Section 1.1.4).



Figure 1.2 The location of the Dutch agrarian companies that co-operated in the research of Area Projecten.

Both Environmental Impact Assessments conclude that the Grensmaas project will have serious consequences on farmers in the area. With this knowledge the farmers were incorporated in the planning and decision making process at an early stage (Maaswerken, 2005). Other stakeholder groups have also been involved since the early stages of the project. In the next section I explore how involvement of different stakeholder groups has taken place.

Stakeholder involvement

As mentioned before, the Grensmaas project affects many stakeholders with a variety of interests. The organisation Maaswerken has stressed the explicit aim to involve stakeholders as much as possible in the decision making process, in order to develop an integrated strategy and broad societal interest and support (Valkering et. al, 2004). From the first year of operation, they have put energy into informing all parties affected by the project works and into making sure formal public participation procedures were followed (Maaswerken, 2004b).

Several stakeholders have special negotiation positions. Rijkswaterstaat Limburg, as one of the future responsible organisations, is an official co-operation partner in the process. This also applies for the nature organisations Natuurmonumenten and Stichting Ark. Af-

ter completing the work, the new river area and additional infrastructure will be transferred to Rijkswaterstaat Limburg and nature areas will be transferred to the nature organisations (Maaswerken, 2005). Several groups are personally invited to participate in discussions, including municipalities and two other important nature organisations, Staatsbosbeheer and Stichting het Limburgs Landschap. In order to balance costs, the project will be paid by profits of gravel extraction. In the Grensmaas area, the company L'Ortye Stein BV has signed the agreement (Maaswerken, 2000). This mutual dependency gives the company a certain amount of power in the planning and decision making process.

For the citizens' group, involvement has included a steady stream of information as the project has unfolded – in the form of press releases and opportunities to review meeting notes, as well as information evenings and the invitation for representatives to take part in consultations. Citizens have been given the opportunity to express their opinions in different stages of the process. Although reactions only served as an exchange of ideas and as a possibility to discover bottlenecks, I have the impression that this has been enough to satisfy the majority of this group, because there has not been serious resistance to the plans (see for example different newsletters and reports). This is not only due to the self-interested goal of safety against flood recurrence, but also to the concerns of this group about expected disamenities, like noise and dust. A test project at the Meers location (see Figure 1.3) offers the opportunity to experiment with different construction techniques. This has been conducted with citizen participation and the transparency of the project is appreciated by the citizens (Maaswerken, 2004c). According to Krywkow *et al* (2004) ongoing information streams aim to improve the satisfaction of the stakeholders. In this case, slow habituation with the project seems to expand citizen acceptance.

In my opinion, the involvement of farmers in the planning and decision making process is a more complicated story. Regarding access to information and invitations to take part in consultations, farmers are involved in the same way as citizens and smaller interest groups, like the navigation sector. Participation reactions are used by policy makers to evaluate their policy, identify bottlenecks and consider alternative solutions, and to take into account different opinions in decision making. However, there is an important difference between farmers and citizens. As shown in section 1.1.3, most of the land that is needed to complete the project is in the farmers' possession.



Figure 1.3 Overview of location Meers (1999), test project in the Grensmaas area.

Source: Maaswerken (2003).

Land with an official governmental designation of necessary intervention can be purchased by the organisation Maaswerken. To achieve this, Maaswerken has established the Grondbureau Maasdal.⁶ The strategy of this organisation is to think of solutions together with farmers (Maaswerken, 2005). This sounds nice, but possible solutions are limited. Examples of alternative solutions, like small adjustments to watercourses, are rare. One of the options for the farmer and his advisor (compensated by Maaswerken) is to accept market prices for his land. After this decision two alternatives are possible. The first alternative is complete abandonment of the land; the second is a lease-contract until the actual work starts. Another option is an exchange of Grensmaas land with land from Grondbureau Maasdal in another part of the Netherlands (Maaswerken, 2005). As one farmer states in a newsletter of Maaswerken: 'They say you make a voluntary choice, but in reality it is a forced situation' (Maaswerken, 2004a). This is because the only option for the farmers is to sell. If they do not co-operate, the government has the right to start a procedure for expropriation, executed by Grondbureau Maasdal.

As mentioned before, participation of citizens and farmers is stressed as important by the Maaswerken. Because the organisation has stressed this importance multiple times, one might expect different involvement methods, for example, negotiated rule-making. This method is characterized as a working committee of stakeholder representatives with high degree of influence on final policy (see Rowe and Frewer, 2000). The methods of information and consultation give the impression of involvement, but they seem largely sym-

⁶ Translates to 'Ground Bureau Maas valley'.

bolic. The farmers are present, but do not possess any power to influence the process. Final judgment will be made by the government.

With this background, what strikes me is the fact that little information can be found on the farmers' opinion. The interests of the farmers are looked after by the LLTB (Limburgse Land- en Tuinbouwbond), which is a regional organisation of the Dutch Organisation for Agriculture and Horticulture (LTO, Land- en Tuinbouw Organisatie Nederland) (LTO, 2005). However, I cannot find any report with their point of view and unfortunately, at the time of writing, the official note with all received reactions had not yet been published. In an interview with Bert Senden (2005), head of Ground Affairs and Environment of the LLTB, he argues that although farmers have taken every opportunity to participate in consultations and to make clear their point of view in formal reactions to notes, the farmers' interests do not appear in the official plans of Maaswerken. The LLTB commends the supply of information of Maaswerken, but, according to Senden '... Maaswerken has not sufficiently come to meet the interests of the farmers. Three issues have been taken into account: every new hectare of nature has been described precisely; safety standards are clear; and gravel extraction has been accurately determined to within ten centimeters. But being aware of the intersection of agricultural land and the influence on farmers' lives, it is to be expected that agriculture would be taken into account as a fourth main objective. However, farmers are not allowed to participate as a partner in the triangle of deliberative parties [Maaswerken, nature organisations, and gravel extractors], and in this perspective Maaswerken has short-comings.'

In this paper I do not focus on the arguments for and against stakeholder involvement, since this is a much broader topic. However, I do argue that involvement strongly depends on the situation. In the case of the Grensmaas, the government has decided to design this project. Policy is based on several objectives, including the necessity to improve safety and to improve national performance on European Treaties such as the Habitat Directive. Where the loss of land is a disadvantage for the farmer as an entrepreneur, the increase of safety is an advantage for the farmer as a citizen, and in some cases as entrepreneur as well. Based on these arguments, I doubt it would have been useful to involve farmers more in the process, since the goals of the plan are fixed. I can also imagine that the possibility to sell property may be a relief for some farmers who have difficulty maintaining their activities of small scale intensive farming in a world of increasing global competition and the impossibility of extending their business, with the Maas on one side and the Juliana Channel on the other.

Nevertheless, not involving all parties in the process means a lost opportunity for more creative and optimal solutions. Moreover, what is missing in the whole story is a legal compulsory consideration of all possible alternatives. It seems that Maaswerken has defined the alternatives to evaluate in the Environmental Impact Assessment, namely the Zero Alternative (autonomous developments), the Preferred Alternative (based on governmental preferences and different interests, and exploring variants like the optimalisation of the storage of contaminated soil), and the Environmental Friendly Alternative (Maaswerken, 2003). Several options have been left out of the plan, and in my opinion, expropriation may not have been the only option to change land use. Although it seems impossible to create a win-win situation for everyone, the gravel contract shows that win-win solutions are possible in river management.

Concerning land use changes, the farmers have two preferences. The first is to restructure the parcel system. In the words of Senden (2005): 'When you have three farms in a row, which will all lose half of their land on the western side, you are left with three amputated companies, which are not viable anymore. Displacement of only a few farms, whereby a better structure of the land could be realized, would already solve a lot. Nonetheless, no attention is paid to this solution and there is no money for the removal of businesses.' The second preference is maximum involvement in agrarian nature management (Senden, 2005). The research of Area Projecten (2003) has indicated that this concept is very well received by the farmers in the area. However, the words 'agrarian nature management' do not appear once in the EIA of 2003.

In the next section I discuss arguments in for and against agrarian nature management, to support the argument that agrarian nature management should have been considered by the decision-making parties as an alternative solution for some farmers in the Grensmaas.

1.1.4 Agrarian nature management

Agrarian nature management is a resource management approach that allows a farmer to retain ownership of the land while he shifts to nature as a new product in his business (LLTB, 2005). When policy objectives for the area are related to nature, a farmer can apply for a subsidy from the governmental National Schemes Service (LASER, Landelijke Service bij Regelingen). The subsidy is often based on the loss of income incurred and, to a lesser extent, to the extra work involved (RIVM, 2004). Examples of sustainable innovation in rural areas are the management of field edges, the protection of birds' nests, the repair of yard plantings, fallow land, and the maintenance of small landscape elements. In general, farming takes place in agri-environmental schemes.

In the next two sections I discuss the pros and cons of agrarian nature management. Through the discussion I develop an answer to the question in the third section: Is agrarian nature management an option to take into consideration in the Grensmaas project?

Agrarian nature management? - The pros

There are several arguments in favour of agrarian nature management:

- Many agrarians have a deep connection with and love for their land. This is demonstrated by an increase in agri-environmental organisations (Melman, 2002). The number of these associations in the Netherlands rose from fewer than 10 in 1994 to 124 in 2004. Membership has also grown, as well as the number of management contracts, especially those under National Schemes Services (Oerlemans et. al, 2004).
- The Netherlands is an intersected country, consequently small scale management is necessary. Agrarian nature management is a cheap alternative compared to the management of reserves, because no ground has to be expropriated (Kleijn et. al, 2002).
- With difficult contemporary economic circumstances for the agrarian sector, there is a high willingness among farmers to co-operate in agri-environmental schemes (Wilson and Hart, 2000).

Agrarian nature management? - The cons

There are several arguments against agrarian nature management:

- A lack of continuity in management, because official agreements are made for a period of six years on a voluntary basis. After the six-year period a farmer can decide to stop and efforts will be lost (Kleijn et. al, 2002).
- Farmers lack expertise on nature management and as a result they do not take correct additional measures, like raising the water level. Also, results are sub-optimal because of an enduring fragmentation of the land, which cuts into migratory routes for plants and animals. Finally, pieces of the puzzle lie in the hands of many different people (Natuurmonumenten, 2002).
- The quality of nature desired in explicit nature areas is not comparable with the quality of nature attainable through management of small pieces of land by different people. This 'farmer-nature' is not enough to meet the standards of the Ecological Main Structure. Nature management can only be taken seriously when the designation of the land is 'nature', not when agriculture remains the main function with nature management as a side function (Natuurmonumenten, 2002). The difference in needs is illustrated in Table 1.3. The same is mentioned by Kleijn et. al (2001), who state that the primary concern of farmers is to secure their income. As a result, nature conservation will be of secondary importance to farmers, and will be fitted to a farming system that, owing to economic pressure, is still increasing in intensity and using too much manure and too many chemical substances for possible surrounding nature areas (Kleijn et. al, 2001).
- Melman (2002) points out the frustration felt by the farmers concerning large amounts of administrative obligations, bureaucracy, and dependency on the government when applying for a subsidy. This provides a negative stimulus.

Table 1.3 Comparison between targets of modern agriculture and nature management.

Modern agriculture	Nature management
Homogeneous soils	Heterogeneous soils
Rich nutrient soils	Poor nutrient soils
Relatively dry	Very wet or dry
Maximum primary production	Low primary production
One dominant species of plants	Range of species
Tillage especially in spring	No tillage in spring

Source: Stortelder et al (2001).

Agrarian nature management: an option to take into consideration in the Grensmaas project?

In evaluating the arguments concerning agrarian nature management, I do not have the impression that an absolute truth exists. Every argument is debatable and this is happening in the literature. In particular, the distinction in Table 1.3 is interpreted in many different ways, with opposite conclusions by experts on the desirability of agrarian nature management. In the Grensmaas project, spatial segregation of agriculture and nature is emphasised by the decision making parties. In their view, agriculture is contrary to nature development (Beukenkamp, 2002). However, in the process of finding an answer to the question on the usefulness of agrarian nature management, a conclusion of Oppermann (2003) attracted my attention. He states that 'up to now a method to measure the biodiversity and ecological benefits of farms is missing.' This is also emphasized by

Kleijn et. al (2001), who mention a big gap in our knowledge of effective agrarian nature management. What is missing are clear indicators to measure accurate levels of nature quality on farms. Besides, impacts of measures are difficult to evaluate because landscapes are complex and diverse, and the effects of new policies are rarely immediate or causal, which is another problem associated with measuring the effects of agri-environmental policy (Oñate et. al, 2000). What is unmistakably clear is that more research is needed before final conclusions can be derived.

According to the decision making parties the discussion on alternatives has to be viewed in the light of autonomous trends, which show a decline of the agricultural sector in the Grensmaas area. Although remaining companies will increase in size, the total size of the sector will decrease (Area Projecten, 2003). The 1997 EIA mentions an expected decrease of 800 to 1000 ha of agrarian land over the next 10 to 20 years (Sommen, 1997). Causes include growing international competition and an increase in the scarcity of ground (the demand for ground will increase). Causes can also be found in ongoing uncertainties, like changing plans and national and international laws, which discourage new activities. However, it is expected that, next to several arable farms, dairy farming will remain a strong sector in the area. To assure their income, these farmers are exploring possibilities of supplementary activities to expand their livelihood strategies (Area Projecten, 2003). These activities include providing camping facilities for tourists on their property and the sale of farm products on-site. Finally, with growing public support and with access to government subsidies, as well as a desire to improve their image, farmers are becoming more and more interested in agrarian nature management.

In my opinion, it would be worthwhile to examine the possibilities of agrarian nature management for dairy farmers, who hold the strongest agrarian position, in economic terms, in the area. At the moment, forelands play an important role for dairy farmers. According to Area Projecten (2003), nature objectives in these forelands fit with dairy companies to a certain level. To prevent forestation of the new nature area of the Grensmaas, herds of grazers, such as Galloway cattle and Konik horses, will be turned out to the open pastures in the areas (Maaswerken, 2004b). With the need of ungulates to maintain aimed nature quality in the area, the question is why domestic animals would not fit this task. The argument that domestic cows are not able to survive on rough land, all year round, is only partly confirmed by Senden (2005). He points out that cows can stay outside to minus ten degrees Celsius. The preservation of a few pastures, in combination with the nature areas, could be enough for the dairy farmers.

In a recent comprehensive study by CLM (2002) in the Dutch province of North Holland, five agricultural branches are described that can exist next to the function of the storage of water. These include beef cattle in combination with nature management and two types of dairy farming. Although physical circumstances of the two areas differ considerably, the conclusions of the CLM research offer a starting point for an exploration on the possibilities in the Grensmaas area. The question is why this research has not been taken into consideration in the Grensmaas project.

To make the management of the new nature areas possible, the government, and especially the Ministry of Agriculture, Nature and Food Quality, will have to provide substantial subsidies to the nature organisations (Teisman, 1995). If there are possibilities for agrarian nature management in the Grensmaas area, policy makers will then face a

choice about who should receive subsidies: the farmers or the nature organisations. Ultimately, this will depend on their objectives concerning the kind of nature they vision in the area, and who they believe will possess the expertise to manage the result.

1.1.5 Conclusion

The Grensmaas project can be seen as an environmental management issue with a high degree of complexity. With the involvement of multiple stakeholder interests, the case becomes further complicated. The group of farmer stakeholders has a special interest in the project, since they are the ones who will lose their land to the new focus on nature. Despite the emphasis Maaswerken has placed on the importance of public participation, I argue that the farmers have not been involved enough in the planning and decision making processes and that the negotiation process should have been more explicit. The existing methods of information and consultation have offered no legal power to influence the outcome of the process.

The government policy is based on a compulsory Environmental Impact Assessment. However, what has become clear is that not every alternative has been taken into consideration. It appears that the decision-making parties act with a 'closed mind', which means they explore policy variants within the framework of their preferences, with little space for new solutions. Results indicate that there is a pressing need for a scientifically sound evaluation of agrarian nature management, with apparent possibilities in the area and a general governmental policy stimulating the concept. Agrarian nature management should not be excluded from the Grensmaas project agenda as a possible solution for local farmers.

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1.2 Biodiversity conservation in the Kresna gorge, SW Bulgaria

Analysis of spatial and stakeholder conflicts, authors Dessislava Krueger, Liesbeth Eshuis.

1.2.1 Introduction

Economic advantages are expected through modernisation of transport routes in Central Europe. Modernisation includes a project to upgrade a two-lane motorway in the Kresna gorge in Southwest Bulgaria. The project may have devastating impacts on both nature and the local population. In this paper we elaborate on the conflict between conservation and infrastructure by using Geographic Information Systems (GIS) and Stakeholder Analysis to examine the spatial and societal aspects of the problem. The spatial component concerns impacts on wildlife induced by two alternatives for motorway construction. Here we emphasise habitat connectivity. A comparison between the alternatives is discussed in the light of biodiversity preservation. Analysis of the societal component is limited by the time available and we therefore focus on the design of a suitable approach for stakeholder analysis. Strengths and weaknesses of this method are discussed within the existing societal framework. Finally, we recognise that real-life situations often require prompt responses that rely on limited scientific data. Therefore, our final goal is to answer the question: Can results obtained through GIS and stakeholder analysis generate relevant solutions in this case study?

Transport development implications for the Kresna gorge

The EU accession procedure in Bulgaria is progressing rapidly. Funds from sources such as the Instrument for Structural Policies for Pre-Accession (ISPA) are available to the Bulgarian government in order to improve the country's infrastructure. In Bulgaria, transport projects are considered a high priority. This corresponds to European Commission goals to increase the mobility of passengers and goods throughout Europe (DG for Energy and Transport, 2000). This paper deals with one of the priority projects of the Trans-European Transport (TEN-T) network: transport corridor No 4. One of its sections in Bulgaria – E79 – is designed to pass through the Struma river valley and, thereby, through the Kresna gorge. This is necessary due to the geomorphology of the area, where the gorge forms the only natural north-south passage of low altitude through the mountains of Rila-Pirin and Rhodopes. The construction proposal consists of upgrading the existing two-lane road at the bottom of the gorge to a six-lane expressway. There is also a plan to replace the old single railway, built into the rocks, with two parallel tracks. These proposals entail cutting across slopes and constructing bridges, tunnels and low viaducts within the gorge (Int. NGOs, 2003).

Biodiversity

The gorge area represents a natural junction between two biogeographic zones – the Mediterranean and the Continental. This effect induces 'biodiversity compression' for species characteristic to either zone and creates conditions favouring endemic species and communities (Beron, 2001). More than 80% of the vegetation is primeval and forms habitats for core populations of reptiles, bats and birds of prey. In addition, it is an important migration corridor for large mammals, such as the brown bear and the wolf. The

gorge is a part of the Via Aristotelis bird migratory route, through which more than one hundred fifty bird species pass every year.⁷ Of the one hundred forty-one sites in Bulgaria to be included in the NATURA 2000 network, the Kresna gorge is ranked seventh in terms of importance. The gorge is designated as a CORINE Biotopes site and is also classified as an Important Bird Area (IBA) of global conservation significance representative of the Mediterranean zone (Za Zemiata, 2002). The Tissata nature reserve (IUCN Category Ib) and CORINE sub-site have been placed in the gorge boundaries (see map 1), however, these cover only 5% of the CORINE site territory. Tissata houses communities of the Mediterranean evergreen sclerophyl and the coniferous *Juniperus excelsa*, which has legal protection. The CORINE site is not yet protected under the existing national legislation. A procedure has been initiated in the Ministry of Environment to establish a nature park merging with the boundaries of the CORINE site. This would delineate additional protected areas.

The stakeholder conflict

In 1997, the Bulgarian Road Executive Agency (REA)⁸, commissioned a plan for the construction of motorway E79 (Berthoud, 2002). Since this section of the motorway will be part of the TEN-T network, the project is supported by the EU Directorate General (DG) of Energy and Transport. The Environmental Impact Assessment (EIA) report accompanying the investigation was rejected, and the Ministry of Environment recommended revision and requested a realistic assessment of alternative routes for Kresna gorge section, 'the Struma Motorway'. The DG of the Environment could only marginally influence the process since Bulgaria is not yet an EU member.

In 1999 the Bulgarian government received 3.3 million Euro through a EU PHARE Cross Boarder Cooperation project. In addition, the Bulgarian government applied for financial support to the EU ISPA programme and to the European Investment Bank. In April 2000, the government contracted with an international engineering firm to design the project and conduct a feasibility study of all related activities. Requirements for a detailed assessment of alternative routes outside the gorge were not included in the Terms of Reference (ToR) of the company until 2001. For that reason, there no serious alternatives were designed or assessed. A decision to include the development of alternatives in the ToR was announced after an EC delegation visited Bulgaria (Krüger, 2003). To date, a comprehensive EIA – one including alternative routes, the designation of the Kresna Protected Area, and a serious assessment of impacts on natural habitats according to EU Directives and International Conventions – has not been conducted (Berthoud, 2002).

Since preparation for the project began, NGOs have raised their concerns about impacts on nature and the local population, and they have tried to influence the outcome of the

⁷ Numerous habitat types, as well as a long list of species, are included in the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and in EU directives on habitats and migrating birds. In particular, twenty-three bird species included in Annex I of the Birds Directive nest in the area (Report by NGOs, 2002).

⁸ Part of the Ministry of Regional Development and Public Works of the Bulgarian government.

process.⁹ NGOs have also drawn attention to the lack of access to information, the exclusion of the local communities in the decision-making process and low rates of public participation (Save the Kresna Gorge, 2004). Bulgaria is a signatory party to the Bern Convention, hence the Convention has served as a mediator, lobbying for support for alternative routes outside the gorge and for the implementation of a comprehensive EIA. In December 2004, the Bern Convention opened a file about the Bulgarian government's lack of action regarding the Kresna case (Kovachev, 2004). Decisions have been mainly top-down, while discontented parties have tried to influence the outcome of the project but have been placed outside the decision arena. We elaborate on these stakeholder issues in Section 1.2.3.

1.2.2 Spatial analysis

GIS materials and methods

The spatial analysis was carried out with the ArcGIS Version 9.0 software package run in a Windows XP environment. The processing of the spatial data and the map creation was done with the programme ArcMap.¹⁰ In addition, georeferencing techniques were applied in order to achieve a suitable projection, where we replaced the Global Coordinate Projection with Albers Equal Area Conic Projection. A Digital Elevation Model (DEM) of the gorge was produced in order to create a spatial impression of the area of interest. A hill-shade layer complementary to the DEM was included in the final version of the maps to support the 3D presentation of the relief. Of particular importance for our project was the creation of various buffers around the planned motorways (both red and green alternatives) and railway. This was necessary in order to estimate the total affected area and the impact on different species groups. Here we referred to available data from UNEP, which has looked at over 600 plant and animal impact studies worldwide using the GLOBIO methodology. The UNEP report the following types of impact zones:

9 The national NGOs alliance formed by a wide range of environmental organisations has initiated a campaign, 'Save the Kresna Gorge', supported by a broad range of international environmental organisations.

10 Some additional functions related to digitising of new objects were performed with ArcCatalogue. The basic maps were derived from the web site www.arcdata.esri.com (2004), however, numerous map components were digitised during the process of map design.

Table 1.4 Zones of impact.

Impact Zone	Definition
Reduced survival and/or abundance of birds	A zone in which there is a high risk of reduced survival or abundance of birds based on more than 50 bird species.
Reduced survival and/or abundance of large mammals	A zone in which there is a high risk of reduced survival or abundance of larger mammals based upon studies of most of the larger predators and hoofed mammals.
Effects on plants, animals, and food chains	A zone in which there is a high risk of effects on ecosystem function, such as changes in proportions of organisms affecting food chains, increased numbers of generalist ("pest") species, vegetation changes, overgrazing, increased risk of predation etc.
Relatively intact ecosystems/wilderness	No or few studies have documented or reported possible impacts. Increase in hunting pressure, tourism and human traffic must, however, be expected.

Source: UNEP (2004).

Table 1.5 Greatest distance of impact for the different ecosystem elements.

	Greatest distance of impact			
Land Use Type	High risk of reduced survival/abundance of birds	High risk of reduced survival/abundance of large mammals	High risk of effects on plants, animals, and food chains	Relatively intact ecosystems/wilderness
All-weather roads	600 m (300 m on both sides)	1,800 m (900 m on both sides)	6,000 m (3,000 m on both sides)	more than 3,000 m on both sides

Source: UNEP (2004) and Cizek (2002).

Buffers (125 m in a whole) corresponding to the total affected area were created using information from Berthoud (2002), where the width of the building site is assumed to be approximately 100 m for a new road system of 25-30 m. For the area destroyed due to railroad construction works we used an equal buffer (125 m) for our maps. A report from BirdLife International (2001) used buffers of 1,000 m and 2,000 m to assess the potential impacts on habitat loss and deterioration on Important Bird Areas as a result of transport network construction. These numbers correspond well to the buffer size defined for our project.

Selection of indicators

The Kresna gorge is a unique biogeographical area. The extremely high average temperatures during the summer (35°- 40°C) and the low humidity, as well as the altitude gradient (200 to 1200 m above sea level) and the geographical position create conditions favouring a huge species variety for a temperate zone (Beron, 2001).

Priority habitats

For this study we emphasise two habitats; both are protected under the EU Habitats Directive:

1. Riparian forests and micro wetlands along the Struma river;

2. *Quercus*, *Juniperus* and *Pinus* woodlands and scrublands covering the slopes of the gorge.

With regard to wildlife conservation, these habitats types are vital for less adaptive faunistic groups such as reptiles, bats and migratory birds. Large carnivores are also dependent on these habitats; they use riverine corridors to migrate north and south, but also as for access to water and particularly as feeding areas in the case of brown bears. In addition, mammals use smaller tributaries flowing into Struma river as secondary corridors for the high mountain ranges of Pirin to the east, and Malashevskia to the west (Report by NGOs, 2002).

Indicator species

Plant or animal species related to a particular kind of environment are called (bio)indicators. The presence of such organisms indicates that specific habitat conditions are also present (www.umpqua-watersheds.org/glossary/gloss_i.html, 2004). A database of species found in the Kresna gorge is available, but the lack of consistent monitoring data makes it virtually useless for spatial research. Therefore, we introduced eight groups of indicators, divided into two subgroups: one covers the important habitat types and the other includes four classes of animal indicators, where the bird fauna is subdivided into three additional groups: migratory, Mediterranean, and birds of prey. In our report major conclusions regarding scenarios for the local biodiversity are based on the indicatory capacity of the different groups (see Hedø et al., 2000).

- Large carnivores

The main threat for the large carnivores throughout the region is habitat fragmentation, mainly due to intensive construction works in the region. In our report, large carnivores is considered to be a key indicator for changes in the habitat connectivity in the area of interest (Linnell et al., 2000). Both wolves and bears inhabit mountainous regions in the southern Balkans. Bears are spread in mountainous areas from 600 to 2600 m altitude, whereas wolves are found in mountainous and semi-mountainous areas. Both species prefer spatial remoteness in regard to human activities. One wolf pack (4 or 5 individuals) inhabits an average home range between 100 and 150 km² (Tsingarska, 2002). An adult male bear in Bulgaria typically covers an area of 500 km² during the fall, whereas home ranges for female bears vary between 13 and 60 km² (Psaurodas, 2002).

- Bats

Bats are sensitive indicators for changes in the riverine habitat, since they utilize it as a feeding and sheltering area. Most important from a conservation point of view are the breeding sites of several big colonies. The Struma river and the gorge slopes up to 400 m are significant for the existing populations because these areas host more than 90% of the known bat roosts. The hunting area of all species is spread over the mouth of the small rivers flowing into Struma, and over the river itself. In addition, the Struma valley is the most important regional migration corridor for bats (Ivanova, 2001). In case of massive habitat destruction, the population density of the different bats species would be altered due to their low reproduction rate and general species vulnerability.

- Birds

Three groups of birds with different ecological requirements are addressed as indicators: migratory birds that react very sensitively to changes in the riparian vegetation and small

wetland patches along the river; birds of prey inhabiting rocky habitats in higher altitude; and the Mediterranean bird species spread over the *Juniperus* habitat. In the gorge, the ecotone effect (mixed riparian forests on the slopes), as well as the rich feeding sources, and the migration route, lead to high concentrations of birds in the bottom of the gorge. In the cases of external direct disturbances (construction works) or indirect disturbances (i.e. noise, air pollution), sensible ecosystem relationships could easily be damaged. Consequently, the proportion of bird species threatened by construction work will be among the highest in comparison with any other faunistic group in the gorge (Report by NGOs, 2002).

- Reptiles

Reptiles are a suitable indicators for short-distance habitat connectivity and the state of habitats along the Struma river. Reproductive populations of two tortoise species and one turtle species are concentrated in the warm low attitude parts of the gorge. In addition, four snake species listed in the Habitats Directive and in Appendix 2 of the Bern Convention are found in all altitudes of the gorge. Different subpopulations¹¹ of reptile species mentioned above are found along the main river, as well as in the lateral valleys of smaller tributaries. Since the reptiles use the bottom of the gorge as a migration corridor, the main risk for them is the isolation of single populations due to upgrading of the existing road. Destruction of habitats is also a serious threat, as reptiles are a vulnerable group due to their low reproduction rates and high dependence on constant environmental conditions (Duharov, 2004).

Results and discussion

In order to define concrete goals for our spatial analysis, we started by breaking down the problem. We defined the following spatial elements as an integral part of our problem definition:

- The existing, and eventually upgraded, road on the bottom of the gorge – red alternative;
 - The alternative proposed by the alliance of NGOs – green alternative;
 - The CORINE site area of 21,858 ha. It is identical to the proposed future protected area;
 - The core area of Tissata reserve (574 ha) divided by the existing road and railroad.
- A flowchart was created to illustrate the discrete steps necessary to prepare the maps. The GIS analysis resulted in five maps, which served as a base to support our assumptions.

¹¹ Subpopulation is a partially isolated population belonging to the same metapopulation of one species. The different subpopulations are able to exchange individuals and recolonise sites in which the species has recently become extinct (www.wikipedia.org).

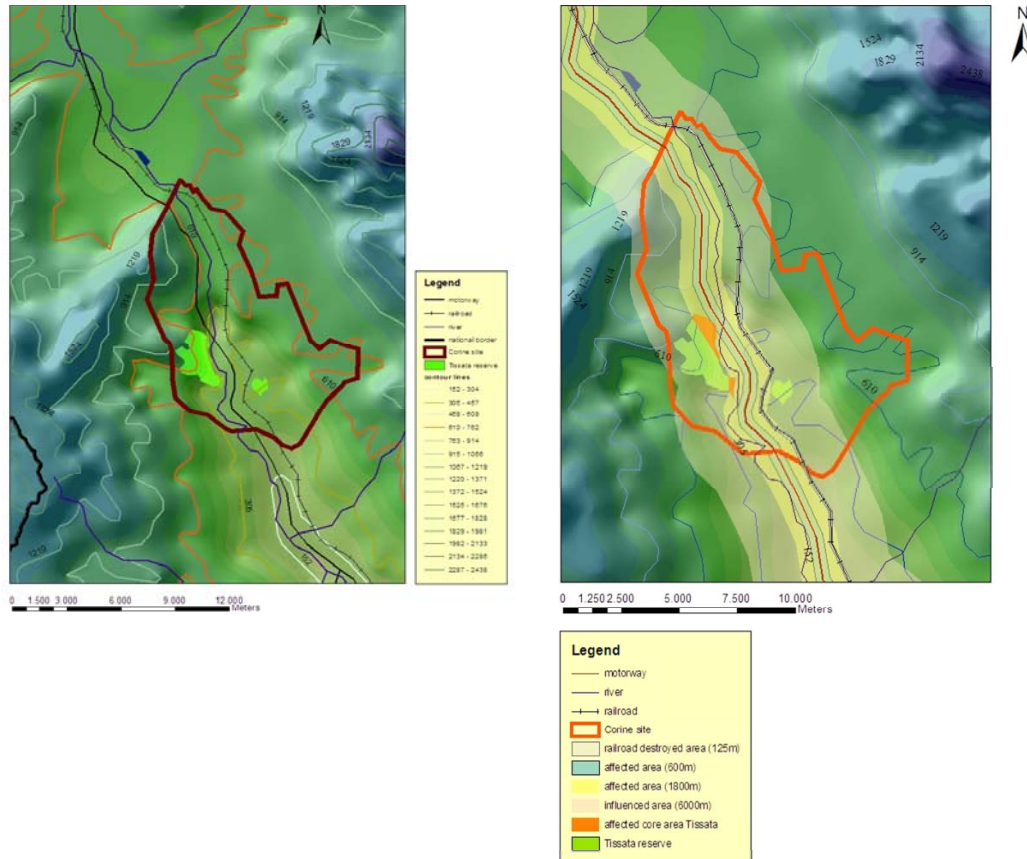


Figure 1.4 Basic map of the Kresna gorge. Figure 1.5 Map of the affected area by the red alternative.

Figure 1.4 presents the whole area of our case study in the local topological context.¹² Figure 1.5 shows the destroyed area (125 m), the affected area (600 and 1800 m), and the influenced area (6000 m) after road upgrades.¹³

Road widening will negatively impact biodiversity and the riparian forests and *Juniperus* woods may be logged during the construction works (Report by NGOs, 2002). Construction activities will affect reptiles, bats, Mediterranean birds, and migratory birds during their passage through the gorge. Presumably wildlife relying on riverine feeding or breeding habitats situated next to the motorway are threatened with extinction due to habitat deterioration. Remote indicator groups will be exposed on the cumulative effect of noise and pollution, which may lead to a drastic decline in the nature value of the area.

Notably, the total riverine area is strongly affected by the yellow buffer (1800 m). This area could represent an effective migration barrier, especially for the large mammals. The predicted negative effect on large carnivorous species, but also on ungulates, will lead to isolation of populations on both sides of the gorge in the long run (see Berthoud

¹² The gorge is hemmed in on both sides by high mountain ranges, and the average altitude of the gorge is 600 m. This map shows the current situation (2004).

¹³ The destroyed area is hardly recognisable due to the resolution used and to the inadequate data set from ESRI (2004). The direct impact of the upgraded road will be obvious only within the buffer zone of Tisvata reserve.

(2002) and Report by NGOs (2002)). The same authors propose a model where the two core areas of Tissata reserve are used as stepping stones between two core areas for large mammals – Pirin and Malashevskia planina. In this case, the red alternative will serve as a barrier (Bennett, 2004). Again, under the yellow buffer are important habitats for Mediterranean and predatory birds, which will be adversely influenced by the upgraded motorway in the upper side of the gorge. At higher altitudes, areas of *Juniperus* scrubland – the main habitat for many birds – will be destroyed by the red alternative. Here we refer to the study of BirdLife International (2001), where in a buffer zone of 1000 to 2000 meter, clear negative impacts on all bird species have been confirmed. A small part of the Tissata core area will be influenced by the yellow buffer, whereas the entire protected area is within the boundaries of the 3 km buffer. Our assumption is that complex ecosystem relationships will be disturbed by effects related to increased road traffic. These effects include noise, ground vibrations, air pollution and water pollution in the Struma river. In regard to habitat connectivity, short-distance (reptiles) and long-distance indicators (large carnivores) will suffer under the lack of habitat integrity.

Figure 1.6 shows the total impact of the motorway among the different indicator groups. Obviously, biodiversity indicators specific to the gorge will be more affected than predator species with ubiquitous abilities and higher mobility. In general, the negative effects on the ecosystem (see buffer 6000 m) will be considerable, since all indicator species will be affected either in direct or indirectly (food chains, habitat deterioration, etc).

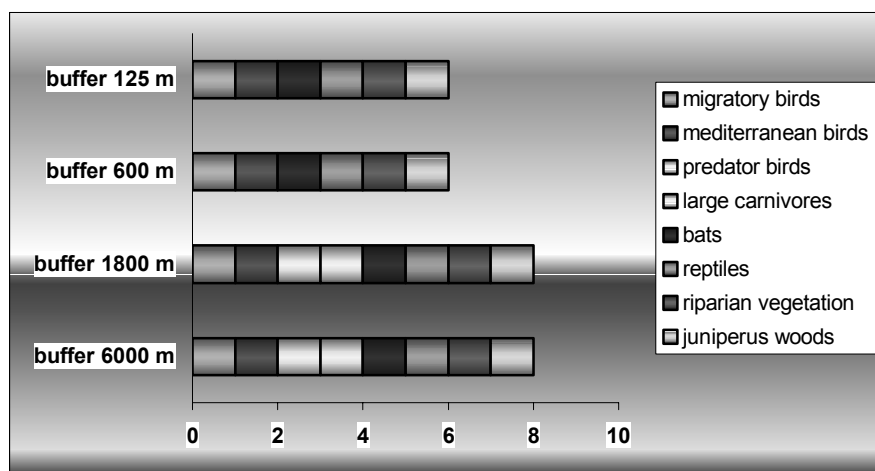


Figure 1.6 Indicator groups influenced by the red alternative.

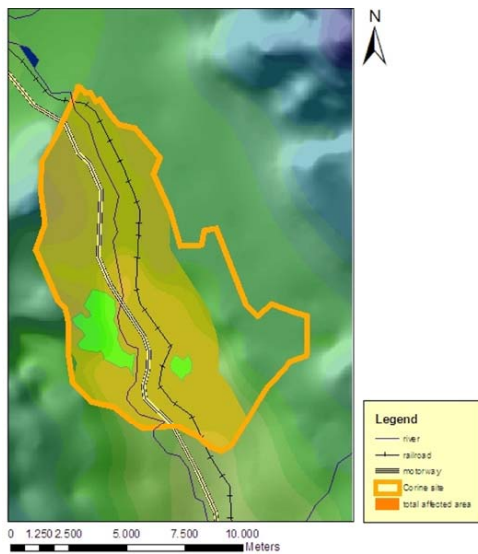


Figure 1.7 Area influenced by the red alternative.

Figure 1.7 presents the total influenced area in the boundaries of the CORINE site, also known as the proposed future protected area. The influenced area covers over 2/3 of the CORINE site, thus the usefulness of the scenario where a protected area will be created, but divided by a highway, is questionable. However, the construction lobby can use this argument to oppose the establishment of a new protected area. Moreover, the core area of Tissata reserve (green shape) lies in the direct radius of influence (affected area) of the motorway.

Figures 1.8 and 1.9 show the situation of an alternative road along the lower slopes of Pirin Mountain. An engineering firm hired by an alliance of Bulgarian environmental NGOs proposed this alternative. The construction of the 'green' variant is feasible despite the high average altitude (700 m above sea level) and the mountainous landscape.

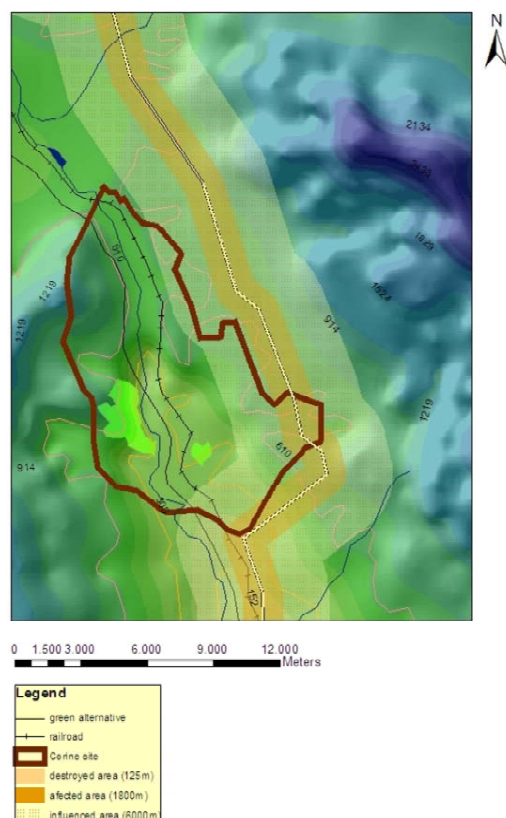


Figure 1.8 Map of the affected area by the green alternative.

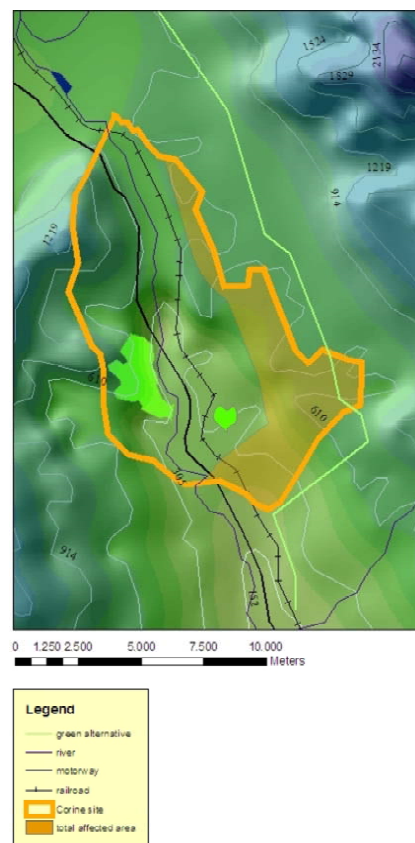


Figure 1.9 Map of the total influenced area by the green alternative.

The advantage of the alternative would be that primarily artificial *Pinus* plantations would be damaged by the construction works while valuable primeval vegetation of Mediterranean type and riparian forests in the Struma valley would be preserved. Additionally, the Tissata reserve would be rescued from degradation. However, the highway structure will remain an effective barrier for large mammals on their way to core areas in the Pirin mountain, unless special constructions (i.e. ecoducts) are included. Birds of prey may also still be at risk. A detailed monitoring study must be carried out to define the degree of their vulnerability. The total affected area of the CORINE site in this case will be less than 1/3 in comparison with the total affected area caused by the red alternative. In addition, the biodiversity of Kresna gorge appears to be preserved. Again, a detailed feasibility study is needed to confirm the apparent advantages of the green alternative. Another aspect to be considered is the effect of likewise extensive construction works on Pirin National Park, where external effects, like earth vibrations caused by the heavy traffic will have unpredictable influence on the unique wildlife. The last concern, however, is not in the scope of this paper, but should be taken into consideration with the designing of future real-life scenarios.

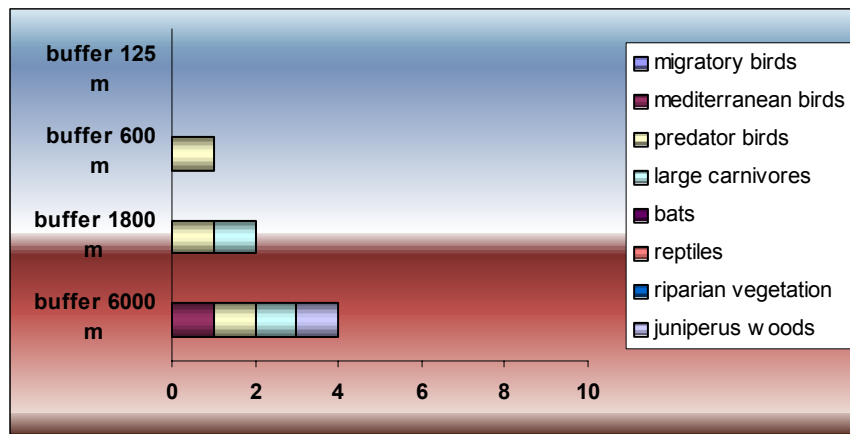


Figure 1.10 Indicator groups influenced by the green alternative.

Figure 1.10 demonstrates the qualitative advantages of the green alternative. Only a small number of indicator species will be affected by the green alternative. However, the majority of indicators we have chosen for this paper are representative of the gorge eco-systems and the result is relevant only in regard to the species at stake.

Strengths and limitations

Despite the fact that we are beginner-level GIS software users, we were able to work with the programme in an independent way. This is, in our eyes, an important precondition for future projects, where we expect to be confronted with similar ‘nature vs. growth’ dilemmas. For the current study, GIS performed well and supplied us with much valuable additional information. The initial maps gave us the incentive to introduce indicator groups, since no field data was available in an appropriate format. We were able to draw relevant conclusions based on the GIS maps. Therefore we think that essential strengths of this method are:

- The capacity to visualise spatial problems in a convincing way;
- The opportunity to emphasise details from a general picture containing key information;
- It is potentially an objective method (if data are not intentionally manipulated)

However, like every technical tool it has a number of limitations. These include:

- We were not able to perform some qualitative analyses (i.e. surface estimates) due to the inaccuracy while digitising new objects;
- The level of performance depends very much on the user level;
- It is time consuming and relatively expensive;
- Data should be consistent and different data sets should be compatible.

Despite these limitations, we think the study could be useful for stakeholder groups since some of the results are presented here for the first time. Furthermore, our work strengthens the case for a comprehensive EIA of the proposed highway construction project.

1.2.3 Stakeholder analysis

While studying the maps, it becomes clear that they do not present the whole picture. Actually, the different perspectives of the social actors on the possible developments are

what make the situation complex. The different perspectives also provide a basis for conflict. To demonstrate the environmental impacts of the Kresna-project, a comprehensive Environmental Impact Assessment must be conducted. This demand has been repeated several times in the Kresna case by different pro-nature parties. Pritchard (1996) defines an EIA as ‘... a process of predicting and evaluating the effects of an action or series of actions on the environment, from which the conclusions are used as a tool in planning and decision-making.’ To perform an EIA, one can choose from a variety of approaches. Sections 1.2.1, 1.2.2 and 1.2.3 of this paper could be used as part of an EIA; Section 1.2.1 as a description of the current situation, and Sections 1.2.2 and 1.2.3 as a discussion on environmental impacts of the red and the green alternative. But a discussion on different stakeholder-dilemmas is missing.

Stakeholder analysis is a technique to identify and assess the importance of key people, groups of people, or institutions that may significantly influence the success of an activity or project (MSH & Unicef, 1998). We want explore this method in order to determine if stakeholder analysis would be a useful tool in this case. We identify people and institutions that will affect, or be affected by, the construction of the motorway. Stakeholder interests exist at different levels. We present the stakeholders in the Kresna conflict from the local to the international level. We introduced most of them in Section 1.2.1. We now add the local population and scientists. Unfortunately, we are bound by some limitations. Most of our stakeholders are citizens of other countries and there are also difficulties related to the time available. Therefore, we present an sample approach, then elaborate on possibilities and difficulties of the stakeholder analysis taking into consideration the red alternative.

Methodological approach

To influence the final decision in a direction more favorable for nature, we have to find answers to questions like ‘What is the position of the pro-nature lobby at the moment?’, ‘What are the perspectives of the different stakeholders that are involved in or affected by the new motorway?’ and ‘How can you have a ‘good quality’ discussion in a case involving local and international politics, in order to create opportunities for nature?’ With the results of our stakeholder analysis we aim at informing people and institutions about the consequences of the construction project on the environment. Additionally, we propose strategies for negotiation in order to find support for a greener alternative among the different stakeholders.

Stakeholder analysis consists of several steps. The first step, according to Gupta (2004), is to identify the gaps in your research. In our case, this is mainly the lack of information about the perspectives of the government and of the local population. The available documents on the effects of the motorway are largely products of the nature protection lobby. The second step is to identify the specific stakeholders, their interests, and the power distribution in the process of decision-making. The results concerning the Kresna case can be found in Table 1.6. A third step would be to define how we are going to fill the informational gap. We designed a list of questions for the local population and one for government officials. The questions are exploratory and therefore as open as possible. The interviews could be held personally or they could be sent to different individuals.

Table 1.6 Stakeholder Analysis Matrix concerning the Kresna-case.

Different parties	Separate stakeholders	Interest(s) in the project	Place in hierarchy of power
Pro-nature lobby	NGO's	Nature	Moderate
	Scientists (ecologists, biologists)	Lives of local people	Unknown (a file on the Kresna case was opened in 2004)
	DG Environment	Reach consensus	
	Bern Convention		
Pro-construction lobby	Government (REA)	Economy	High
	DG Transport	EU unity	
	Scientists (sociologists, social geographers, economists)		
Remaining parties	Local community	Secure livelihood	Low

The final step of our stakeholder analysis is to develop strategies to obtain the most effective stakeholder support possible and to reduce opposition for successful implementation of an alternative more favourable for nature. In Table 1.7 we present our considerations on potential strategies.

Table 1.7 Potential 'Save Kresna Gorge' strategies.

	Pro-nature lobby	Pro-construction lobby	Remaining parties
Potential 'Save Kresna Gorge' strategies for obtaining support or reducing opposition	Work on coalition building, increase pressure on pro-construction parties and lobby to involve remaining parties.	Present GIS and interview results (define approach on basis of interviews), pressure pro-construction lobby to implement comprehensive EIA and involve community	Spread information on the project, work on coalition building by emphasising personal profit.

The role of scientists is unclear. We assume that ecologists and biologists are joined with NGOs. Although these scientists provide important environmental reasons for political action, this will only mobilise policymakers if there is consensus about the problem (Gupta, 2004). It is likely, however, that there will be scientific research in favour of construction. An example could be research performed by sociologists or social geographers on 'sense of place'.¹⁴ A 'sense of place' could be related to the EU enlargement. To create a feeling of unity and 'being European' the EU wants to find out if people feel connected to the EU and how to strengthen such feelings. Infrastructural accessibility is an important issue in this case. On the other hand, 'sense of place' is also related to national natural heritage that contribute to a feeling of national pride. What becomes clear is that scientists are not a unified stakeholder group. However, expert judgement can be

¹⁴ This concept is related to the imagination of a place, derived from stories, pictures, media or own experiences that can lead to feelings of connection or rejection. Derived from this, places can become part of people's identities (Massey & Jess, 1996).

used to underline the negative effects of the red alternative and to provide strong arguments in favour of the green alternative.

Is the stakeholder analysis a useful tool in the Kresna-conflict?

The local population is a group of stakeholders affected by the Kresna motorway project. These people will experience disturbance from increased traffic, a deterioration of air quality due to vehicle exhaust, and a decrease in safety conditions. Additionally, there will be a loss of agricultural land and a decreased potential for the development of ecotourism as a livelihood next to agriculture and cattle breeding (Save the Kresna Gorge, 2004). However, local community participation was weak at public consultations in 2002 (Berthoud, 2002). Based on this, we doubt if the local people are involved in the decision making process or if they are aware that their interests are at stake. Also, there is often a general feeling of scepticism among the rural population. These people usually experience their participation in the process as a formality. Since the preliminary distribution of documentation was considered to be insufficient, since no comprehensive EIA has been conducted and since a lack of access to information is a fact (Save the Kresna Gorge, 2004), we doubt the government is willing to involve the local population in the process.

A core idea of the stakeholder analysis is the concept that local people are seen as a potential resource for information; they know best what is best for them and for their surrounding environment, which is based on cumulative knowledge of generations (Hughes, 1998). This 'idea of knowledge' is a point of consideration in the Kresna case. Here, the knowledge and connected perspective of the local people regarding the motorway is not clear. Therefore, an interview survey is necessary. Since the distribution of information has been insufficient, we can assume that local levels of knowledge regarding the E79 project are low. Yet the construction will significantly affect local communities. It is to be expected that the motivation of these people to choose a side in the conflict will be based on economic reasons, namely safeguarding their livelihoods. The NGOs can offer information to convince them of a win-situation if they would join the pro-nature parties. However, the overall influence of the local population may remain low, and to involve them will probably take a great deal of time. Finally, it is uncertain if this group wishes to join the coalition as an active party.

Another uncertainty is the involvement of pro-nature stakeholders in the decision making process. Until now the government has not shown any willingness to cooperate or negotiate in the Kresna case and decisions are generally top-down. This is an unfavourable scenario for nature, because conservation is not the main priority of the most powerful parties. A basic idea of the stakeholder analysis is to provide stakeholder parties with a voice, but to persuade influential parties to involve other stakeholders in the process they have to be convinced of the advantage of this. Also, the motorway will have different effects at the local, national, and international levels. The dilemma with choosing an alternative results in the insight that the consequences for these different levels are not comparable. The stakeholder analysis does not solve conflicts based on values trade-offs. However, it does provide a tool to influence decision-makers in the process of giving weight to different arguments from different stakeholders.

In conclusion, stakeholder analysis is complex, time-consuming and expensive research, and public involvement should be sought at the earliest possible stage of planning a quality improvement initiative (Gupta, 2004). This is recommended as a way to reduce or even prevent conflict by discovering common interests among the parties. In the Kresna case this has not happened. The failure of REA to produce a comprehensive EIA is an example: a direct consequence may be that responsible governmental officials are not aware of the possible alternatives of the construction of the motorway. If pro-nature parties can propose alternatives corresponding with the interests of the influential parties, the arena of options for negotiation could be larger than initially expected. And since the NGOs have accepted the construction of a motorway, this could be a starting point for negotiation.

Strengths and limitations

Although we concluded in the former section that GIS Spatial Analysis is a useful tool, it is clear that maps alone are not enough to protect nature. One also needs other methods. In this section we presented a possible approach for a stakeholder analysis to address the societal aspects of the Kresna case. Even though we only set a framework for the analysis, we were able to draw some conclusions in favour of the stakeholder analysis. These are based on our literature study and on preliminary results of the proposed stakeholder analysis:

- A stakeholder analysis is particularly useful in defining the stakeholders and their perspectives. One can use results to develop strategies to obtain support for one's proposal among different groups of stakeholders.
- The stakeholder analysis provides the opportunity to find a common ground of interests among the different stakeholders.

Some existing limitations in the Kresna case could hinder the process of moving forward in the negotiation arena. These could be reflected in the outcome of our proposed stakeholder analysis:

- Forming coalitions is difficult and it is not always clear if efforts will be rewarded (for example, efforts to include local people as a pro-nature party).
- A stakeholder analysis should be carried out in an early stage of project preparation. In the Kresna case it may be too late, since the construction plans are in an advanced stage (Save the Kresna Gorge, 2004).
- Stakeholder conflicts may be the result of a structural power imbalance. A problem in the stakeholder analysis is the lack of a mechanism to convince decision-makers to accept a more bottom-up approach.
- The problem may affect parties from the local to the international level. A problem is the valuation of different interests and therefore we recommend other supporting methods, such as multi-criteria analyses (MCA) or cost-benefit analyses (CBA).

1.2.4 Conclusion

The goal we set with this paper was to prove that our results have the potential to generate relevant conclusions for biodiversity and humans in this particular case study. Despite some methodological limitations, using GIS and stakeholder analysis together can be convincing when it comes to addressing 'nature vs. growth' conflicts. In the Kresna

case, the GIS analysis was especially valuable visualising the problem. With the results of the stakeholder analysis, strategies could be defined to make the spatial performance accessible to the general public. In addition, with the help of GIS results pressure could be put on decision-makers.

During the work on this paper we came to the conclusion that both methods should be applied in an early stage in case studies like the Kresna gorge in order to influence the project development from the beginning. This would also allow for the discovery of common interests at an early stage and the use of these as a starting point for negotiation. However, a combination of both methods is not enough to protect nature. In cases like these, trade-offs between conservation ideals and economic priorities require more decision support tools. Consequently, the application of a suitable valuation technique is crucial in order to define the value of the biodiversity of Kresna gorge for all stakeholders involved.

Acknowledgments

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1.3 Linking international trade to the struggle of indigenous peoples for the environment and political sovereignty

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1.3.1 Introduction

Indigenous Peoples¹⁵ have a unique relationship to the environment in which the political, social, cultural, economic, and spiritual spheres interact in complex ways that cannot be easily disconnected. Examples of this interconnectedness include views of animals as kinfolk, the use of medicinal plants, the importance of sacred sites, and extensive food harvesting activities (Barsh & Henderson, 2003). As a result, it could be said that Indigenous environmentalism exists as a facet of deeper issues concerning ownership and sovereignty. After centuries of struggling against colonialist agendas, Indigenous peoples now face new threats associated with the complex phenomenon of globalisation. In order to narrow our research, we focus on international trade agreements. As countries sign international trade agreements, some people raise questions about how these agreements

¹⁵ We use the terms Indigenous, Aboriginal, and First Nation(s) interchangeably. We also use the term sovereignty, which we define as the full independence of Indigenous peoples from outside authority. This is not to be confused with the concept of self governance, which refers to the increased authority of Indigenous peoples within existing political structures.

affect environment and social equity. What is the bottom line for measuring effects on Indigenous Peoples? We propose that the bottom line is the Indigenous Peoples themselves; those who are most affected. Is anyone making this connection?

In researching the effects that international trade agreements have on national environmental policy *and* Indigenous Peoples, we did not find a connection within existing literature. The literature reflects wider societal concerns about how international trade agreements affect national sovereignty and environmental and social policies. There are studies that examine the struggles of Indigenous Peoples with respect to environment and sovereignty, and some of these studies will be discussed in our paper. However, we did not find any studies specifically linking trade agreements to Indigenous peoples. Indigenous Peoples are not specifically considered within trade agreements despite numerous international treaties and policies that recognise their unique situation in relation to inherent conflicts in the Western definition of 'development' (Blaser et. al, 2004).

To explore this topic, we focus on two case studies. One involves the Cree of James Bay, Québec, Canada, within the context of the North American Free Trade Agreement (NAFTA) and the other considers the Dayak Meratus of Indonesia within the context of the World Trade Organisation (WTO).¹⁶ We review the existing literature related to these cases and then offer two sets of recommendations – the first about research into the relationship between international trade agreements and Indigenous peoples and the second about how to reform of NAFTA and the WTO to include Indigenous peoples. Since these recommendations can only be made broadly at this point, they also function as topics of further research. In the article we make use of secondary sources such as peer-reviewed journals, websites, news articles, academic books, and international agreements and conventions. The approach is socio-political and normative in nature. We begin with background information on the James Bay Cree and the Dayak peoples of Indonesia. We also outline NAFTA and the WTO. Within the case studies, we review and report on some current literature and follow this with our own analysis of the cases with respect to globalisation and internationalism. Our recommendations and conclusions complete the analysis.

1.3.2 Background & preliminary discussions

In this section, we discuss background information and existing literature for the case studies. We argue that existing information may be linked to answer the question of why the interests of Indigenous peoples should be included in international trade agreements. This may then provide a basis for researching how to include them as equal partners in

16 The Dayak Meratus and the Cree Nation are useful examples. Both cases are widely-recognised. A large academic literature base for the Cree allows for examination of lack of issue-linkages. Research on the Dayak is minimal, but their struggle is well-publicised by NGO's. With respect to NAFTA and the WTO, there may be an interesting analysis about the effects of the WTO, which operates on a global level, and NAFTA, which operates on a smaller scale (Canada, United States, and Mexico). Also, Canada promotes itself as a supporter of Indigenous rights while maintaining a different policy nationally – it is therefore important to challenge this reputation and link this policy international trade (Barsh & Henderson, 2003).

trade as guided by trade agreements, perhaps by recommending reforms, and how to research what effects the current trade agreements are having on Indigenous peoples.¹⁷

1.3.3 Case study: James Bay Cree & NAFTA

The scope of this paper does not allow for a full discussion of the legal institutions built around Indigenous peoples in Canada. For an introductory overview, we recommend John Steckley, *Full Circle: Canada's First Nations* (2001). In addition, although significant industrial development is occurring in Cree territory, this paper focuses on hydroelectric power projects. Generally, it has been shown that the introduction of hydro-power development opened the door to further development (Whiteman, 2004). Here we present background information and review current studies, then draw conclusions about the links between the Cree and NAFTA.

Geography and Social Structure of the James Bay Cree

James Bay is a sub-arctic region at the southern end of Hudson's Bay in Canada. The Cree, who number approximately 14,000 and refer to themselves as Eeyouch, live in nine communities dispersed over the area they call Eeyou Istchee. Harsh environmental conditions kept non-Indigenous activities from seriously affecting the Cree until the mid-17th century, when Hudson's Bay Company claimed Eeyou Istchee under a royal charter (Whiteman, 2004).¹⁸ Cree territory was transferred to the province of Québec in 1912 under the *Boundary Extension Act*, which stated that development could not occur on any land unless the Indigenous Peoples surrendered ownership. External influences remained minimal until the 1930s, when beaver preserve areas were established in the area. In 1947 the *Indian Act of Canada* combined pre-existing governmental policies related to Indigenous Peoples. A new political system was enforced that replaced the egalitarian Cree system of Outchimaou and Elders (Whiteman, 2004; Peters, 1992).¹⁹ This new system remains subject to the authority and veto of the Minister of Indian Affairs.

¹⁷ A short point regarding the style of the authors and their focus within the case studies is necessary. The James Bay Cree study takes a radical approach to questioning national sovereignty while the Dayak study takes a more moderate, nationalistic approach. This difference does not impact the comparison of the studies but raises an interesting North-South issue within research methodology.

¹⁸ Hunting and trapping formed the basis of Cree life for centuries and their lands were divided into family harvesting territories. The Outchimaou, who is a senior hunter and leader, managed the land and people according to traditional knowledge (Whiteman, 2004; Grand Council of the Crees, 2005).

¹⁹ Although the Outchimaou still exist, their influence is diminishing and Whiteman's study (2004) discusses the decline of the Outchimaou and their traditional environmental knowledge as a result of the hydroelectric projects in Eeyou Istchee.



Figure 1.11 Cree Communities of Québec.

Hydroelectric Mega-projects

In the 1970s, the province of Québec began construction of phase I of the James Bay Hydroelectric Project in Eeyou Istchee without consent of the Cree. Since the Cree had not negotiated surrender of their territory, as required by the *Boundary Extension Act*, the development occurred on unceded lands. The Cree approached the province to negotiate but this attempt failed. From this point onward, the Cree have relied heavily on the courts to enforce recognition of their rights. The James Bay and Northern Québec Agreement (JBNQA) was signed in 1975. It was the first modern land claims agreement in Canada.²⁰ Phase I of the James Bay Hydroelectric Project included nine dams and more than two hundred dikes. Four major rivers were diverted into the La Grande and 11,341 square kilometers of forest land were flooded. Plans for Phase II, which is now under construction, include 38 dams and 461 dikes. As one of the world's largest hydro-power projects, the James Bay Hydroelectric Project has seriously altered the entire Hudson Bay/James Bay ecosystem and significantly affected Cree society (Sierra Club, 2005).

²⁰ It was negotiated because the government hoped 1) to avoid having damages awarded to the Cree by the courts as a result of the hydro project and, 2) to assert control over Eeyou Istchee for the purpose of economic development (Peters, 1992). Usher et. al (1992: 129) conclude that although Canada has acknowledged Aboriginal title in various (limited) forms, the recognition was only to "facilitate peaceful development of land and resources.... [and was] a product of native insistence".



Figure 1.12 James Bay and Northern Québec Agreement, 1975.

Current literature

In this section, we discuss current literature regarding the James Bay Cree and their experiences in breaking ground for active recognition of Indigenous rights in the face of the Canadian government's machinations of progress and development. We aim to later elucidate the gaps in the literature that should be filled to gain a better understanding of the link between development, international trade and Indigenous peoples. We limit our review to recent studies and focus on several relevant themes. First, we discuss the social, economic, and environmental effects of the James Bay development. Second, we propose that the reticence of the signatories of the JBNQA to implement provisions of Canadian and international law is a micro-reflection of their parallel failure to comply with domestic and international laws recognising Indigenous rights. Third, we examine how the neo-colonial value system that guides development may be extended to a discussion on international trade.

The mid-1970s was the beginning of the era of modern treaty negotiations as a “new approach to finding permanent solutions for Aboriginal economic and social problems” (Saku, 2001, 141).²¹ In 1971, the James Bay Cree had not yet ceded the territory that was to become the site of the James Bay Hydroelectric Project.²² After negotiations failed,

²¹ Peters (1992) discusses land claims as one method that Indigenous Peoples have used to prevent or mitigate development of their traditional territories.

²² According to the 1912 Boundary Extension Act, Québec was required to obtain that surrender before pursuing development (Peters, 1992; Rynard, 2001).

the Cree pursued legal channels.²³ Initial court judgements were in the Cree's favour and the government, concerned that the Cree might be awarded damages, chose to negotiate and sign the JBNQA. The Cree were under pressure to sign because they could not stop the construction (Peters, 1992).²⁴ The provincial and national governments then took actions contrary to the provisions of the JBNQA. These actions, which directly violated Canadian law, are extensively documented in the literature (see Rynard, 2001, or Whiteman, 2004). Usher *et al.* (1992) point out that Canada's land claims negotiations insist "on linking the recognition of aboriginal title with the extinguishment of aboriginal rights in exchange for compensation" (129).²⁵ This point could open a discussion on compliance and norms and values. We link Canada's history of avoiding legal responsibilities under the JBNQA to a discussion of Canada's legal obligations under international law. Canada's compliance, or lack thereof, with national and international law has implications for reformation of NAFTA and for rethinking Indigenous participation in international trade agreements.

The crux of this case study is that normative changes are central to changing international trade agreements. Canada promotes a "positive image of Canadian leadership in the empowerment of Indigenous peoples" (Barsh & Henderson, 2003, 45), but its domestic practices contradict this image. Indigenous peoples' goals of sovereignty conflict with the federal government's reasons for negotiating – namely, to gain control over resources and prevent full Indigenous sovereignty. The James Bay Cree continued to negotiate because they recognized 'that they had very little choice' (Rynard, 2001; Coon Come, 2004). Although the Cree gained more authority under the JBNQA, the bottom line was established before the JBNQA: development is inevitable, necessary and positive. Coon Come, former Grand Chief of the Grand Council of the Crees and former National Chief of the Assembly of First Nations of Canada, explains that "Canada refused to intervene on our behalf, Hydro-Quebec held a gun to our heads – the destruction of our lands and rivers continued daily while we negotiated" (Coon Come, 2004, 156). The Cree were involved retroactively and the burden was on them to prove a reason for inclusion. The Cree continue efforts to improve the JBNQA. In February 2002, they signed a new

²³ The court proceedings related to the JBNQA had severe social and economic impacts. These types of impacts must be considered when proposing the inclusion of Indigenous peoples in trade agreements.

²⁴ In light of the power imbalance between the parties, and the fact that construction on the project had already started, the Cree felt impelled to negotiate to the best of their ability rather than be left out completely.

²⁵ Indigenous peoples are "still disadvantaged people in Canada" (Saku and Bone, 2001, 260) as a result of the disruption of traditional life and loss of control over land. Modern land claims offer increased control, but this remains limited because significant control is retained by the government. Saku and Bone show that modern treaties alone cannot create favourable economic situations and that by focusing on development and the wage economy, Indigenous peoples lose culture and language. Rosenberg *et al.* (1995) state that subsistence economies of Indigenous people, such as the Cree, are particularly sensitive to industrial development because changes to resource use and harvesting patterns affect "established systems of land tenure and resource management, the organization of production and distribution" (143).

agreement with the provincial government,²⁶ which focuses on implementation of Québec's obligations pertaining to community development under Section 28 of the JBNQA.²⁷ The federal government has similar obligations, but it has not yet negotiated an agreement (Grand Council of the Crees, 2005).

Linking the James Bay Cree to NAFTA

Although development of Cree territory began in 1970 and NAFTA²⁸ was signed in 1994, there is reason to link them together. As discussed above, the normative question of development as conceived by the province of Québec in relation to developing the hydroelectric potential of Cree territory has not been addressed by the province. The perception of progress as an inevitable and positive force underpins the foundation of international trade. The province of Québec, a French speaking province in conflict with the English speaking national government, often seeks to assert its own sovereignty from Canada. To do so, it must achieve a reasonable level of economic independence and form new alliances with trade partners outside of Canada. NAFTA enables these kinds of partnerships, and although NAFTA was signed more than 20 years after the onset of hydro development of Cree lands, it promotes the similar values and further encourages new development by creating opportunities for the province to achieve its goals. Trade with the US and Mexico increases through NAFTA and new relationships are formed as a result.

Evidence of a potential link between NAFTA and Indigenous peoples in Canada has been acknowledged by the national government. In 1998, Dennis Wallace, then Deputy Minister of the federal Indian Affairs and Northern Development, said that while NAFTA has benefited Canada, the U.S. and Mexico as a whole, "Aboriginal people have not been able to fully embrace its opportunities or reap its benefits" (Weinburg, 1998). At the same time, a *First Nations NAFTA International Summit & Trade Show* was held by the government to promote Indigenous participation in trade under NAFTA.²⁹ The government believed that NAFTA could help Indigenous Peoples increase economic development, employment and self sufficiency by encouraging joint ventures and trade (Weinberg, 1998). However, Weinberg noted that before NAFTA was signed, the Liberal Party, who sat in opposition to the Conservative Party in Canadian Parliament, introduced an amendment to NAFTA that stated that "nothing in NAFTA should supercede Aboriginal and treaty rights" (1998). The amendment was defeated. Thus, Indige-

26 Agreement Respecting a New Relationship Between the Cree Nation and the Government of Québec.

27 The new agreement also implements recommendations of the Royal Commission on Aboriginal Peoples by providing the Cree with equal participation in the employment opportunities and revenues created by developing Cree lands and resources.

28 The North American Free Trade Agreement (NAFTA) was signed in January 1994. It promotes free trade between Canada, Mexico and the US by providing a legal framework for reducing trade tariffs and limiting disputes. NAFTA aims to: create an expanded and secure market for the goods and services produced in their territories, enhance the competitiveness of their firms in global markets, create new employment opportunities and improve working conditions and living standards in their respective territories, and protect, enhance and enforce basic workers' rights (HRSDC, 2005).

29 In Calgary, Alberta, Canada

nous rights were included in the initial debates around NAFTA but were not incorporated into the NAFTA provisions in a meaningful way.

Several issues were raised with respect to the *First Nations NAFTA International Summit & Trade Show*. The government and Indian Affairs saw the Summit as a way to encourage banks to give loans to Indigenous Peoples.³⁰ Academics criticised the Summit as a land grab and believed it would negatively impact traditional collective ownership (Weinberg, 1998).³¹ Some members of the Mohawk Nation were also sceptical.³² Their question was about who defines sovereignty and why should Indigenous people participate in NAFTA if Indigenous sovereignty will not be addressed? Since dissenting Indigenous peoples, such as the Zapatistas in Mexico, had not been invited to give input on NAFTA, why would other Indigenous peoples put themselves in the position of becoming agents of Canada, US and Mexico in human rights violations against fellow Indigenous peoples (Mohawk Nation News, September 1998)?³³ Here, norms and values are in direct conflict and similar themes present themselves in the case of the James Bay Cree and the hydroelectric projects on their land.

Current literature on NAFTA

Ten years after it was enacted, NAFTA has once again become a hot topic. Although trade is apparently skyrocketing under NAFTA, on-going trade disputes raise the question of reform.³⁴ Our analysis regarding Indigenous peoples should add to the debate about reform of NAFTA. Where politicians point to issues of efficiency, we point to issues of equity. Although groups are challenging NAFTA on the basis of social equity, we question whether they take their definition of equity far enough.³⁵ Their issues are nationalistic and our objective is to examine the framework of international trade that allows Indigenous Peoples to be dispossessed for the purpose of obtaining access to natural resources. Our research therefore also questions nationalism and identity.

30 Indigenous people in Canada have difficulty getting loans because their reserve land is collectively owned. Thus, they may not have collateral to cover the loan.

31 Their argument was that it was a way to get Indigenous assent to NAFTA. The importance of gaining this assent may be a "scheme to get some Indian leadership to sign away rights that have been violated by NAFTA" (Weinberg, 1998).

32 They said that NAFTA, as an agreement between Canada, US, and Mexico, failed to recognize "the true traditional Indigenous sovereign nations ... [who are not being] consulted on this latest maneuver to sell off their resources to benefit the multinational corporations who are behind this whole thing" (Mohawk Nation News, September 1998).

33 These sentiments are mirrored in the Resolution on Decolonisation for Indigenous Peoples of the Pacific, 1996, from the Indigenous Peoples of the Pacific Workshop, which states that "...NAFTA [represents] an intensification of colonialism, compounding further genocide against Indigenous Peoples".

34 Paul Martin, Prime Minister of Canada, for example, hopes to strengthen the supervisory panels that are intended to resolve disputes.

35 For example, the Council of Canadians, a public lobbying group, and the Canadian Postal Workers Union are currently pursuing legal channels to question the Agreement's constitutionality. They charge that NAFTA violates Canada's constitution by allowing foreign companies to sue the national government via international tribunals, bypassing the Canadian court system.

According to Steven Chase of the Canadian *Globe and Mail* (09 March 2005), issues of sovereignty are central to disputes between the U.S. and Canada under NAFTA. The dispute resolution panel established under NAFTA Chapter 19 has largely decided in favour of Canada. The U.S. has then ignored these decisions.³⁶ Sovereignty is a popular theme in the literature on NAFTA. We propose that Indigenous sovereignty could be included in such discussions. Recent studies of NAFTA focus on issues of governance, environment and sovereignty. Sanchez (2002) examines the new forms of governance that are emerging as a result of NAFTA and how there are “generally diminished expectations that the agreement’s environmental provisions and institutional frameworks will help control negative environmental consequences of increased trade” (1369). He argues that NAFTA’s environmental provisions have been narrowly interpreted in order to avoid trade barriers and to promote investment. With respect to the earlier question about Indigenous rights being superceded by NAFTA, we wonder if Indigenous peoples are considered partners in trade or, rather, barriers to trade, because of their close relationship with the environment.

Signatories to NAFTA were pressured by NGOs to include provisions for the environment. These provisions and the creation of related commissions raised societal expectations. However, Sanchez notes these mechanisms are largely ineffective. Internal differences and differences between governments prevent NAFTA committees from protecting the environment. Sanchez further argues that the lack of public participation, the use of private arbitration, and the declining involvement of NGOs have affected NAFTA’s transparency and have allowed for increased involvement of the trade community (individuals investors or companies). Oliver (2005) notes that international trade agreements, which focus on trade liberalisation and “shift sovereignty to...newly created ‘supranational organisms’” (55), limit the ability of governments to regulate the environment and public health. There is also a conflict between trade and the environment because economic concerns overshadow environment concerns. If private property rights are strengthened for foreign corporations to the detriment of ownership rights for those operating domestically as Oliver (2005) suggests, we ask how much further Indigenous ownership is eroded as both domestic and foreign investors compete with Indigenous land claims. Disputes within the tribunal rely on the credibility of ‘scientific’ evidence (Oliver 2005). What are the consequences of this for a dispute involving Indigenous peoples and their lands? Reliance on ‘scientific’ knowledge may render traditional knowledge insignificant or ignore Indigenous methodologies of Oral Tradition.

In this brief discussion, we have focused on a few themes in the literature that suggest a need for reform of NAFTA in order to make it culturally appropriate to the rights of the Indigenous peoples that the government of Canada and corporations are courting as trade and joint-venture partners. Let us propose that, ideally, Indigenous peoples should be partners of equal standing.

NAFTA Reform

Reform of NAFTA is not a new idea in Canada. Concerns about how the agreement is generally functioning compared to original expectations are common. That Indigenous

36 The softwood lumber dispute is an example of this.

interests are potentially affected by NAFTA has been publicly acknowledged, however briefly, by the national government. To recommend that ideas of reform be extended to include the interests of Indigenous peoples would begin to address fundamental issues of inequity. These interests are a missing link in the dialogue between trade and environment and could potentially facilitate increased communication between the two committees, NACEC and the *Free Trade Commission*. As we have seen in the James Bay Cree case, their perseverance in attempting to work in partnership with the provincial and national governments, despite hardship, is inspiring. We therefore recommend establishing a new side agreement to NAFTA on the cooperative implementation of Indigenous rights in trade and the environment, perhaps titled: *North American Agreement on the Cooperative Implementation of Indigenous Rights in Trade and Environment*.

Meaningful design, implementation and operation of such an agreement would not only require public participation but include the equal participation of Indigenous peoples. This should provide the necessary financial and technical support and increase access to knowledge. This level of participation would be a step toward eliminating the treatment of Indigenous peoples as a barrier to trade and would also elevate the treatment of the environment. Once these additions to the institutional structure are made, the committees could work together to debate other issues such as the concept of private property, harmonisation of Western science and traditional ecological knowledge, and the role of Indigenous governance in trade disputes. While the ultimate goal is that of Indigenous peoples as equal, sovereign signatories of international trade agreements, rethinking an entire national identity is not a realistic starting point for reform. Small, institutional steps such as reform of trade agreements to include equal participation of Indigenous peoples by recognising their legal rights may contribute to a paradigm shift. We remain open to the possibilities to instigate a shift in the global consciousness.

Case study: Dayak Meratus and the WTO

In this case study, we look at a group of Indigenous peoples in Indonesia, the Dayak.³⁷ We examine the economic activities currently occurring in their territory, specifically mining and forest-related activities that are linked with international trade. We argue that these developments are part of a larger push for global economic integration and that the Dayak have not been consulted despite the fact that their lands are being developed. We aim to link these developments and the WTO, although this is difficult because literature about the Dayak is limited. The main idea is that development, as an overarching idea, drives the Indonesian government's desire to achieve economic independence. Although the Dayak case cannot be tied to the WTO via tribunal dispute resolutions, there is reason to believe that Indonesia's participation in the WTO as a developing country requires it to bring in foreign investment. Further research might link these investments to the WTO.

³⁷ The Dayak were once known as "the legendary natives of Borneo" who lived in longhouses and hunted animals and humans. They also engaged in traditional agriculture and conservation practices.

The Meratus Mountain Range and the Dayak Meratus

The Meratus Mountain Range is at the centre of South Kalimantan (Borneo), Indonesia. The mountain areas are regulated by eight administrative districts, or *Kabupaten*.³⁸ The mountains contain the last stretch of native forest in Kalimantan and have been recognised for their biodiversity and water catchment functions – the area has had protected status since 1928.³⁹ The Dayak Meratus are a group of Indigenous peoples who inhabit the Meratus Mountain Range,⁴⁰ where they can utilize land as they need and the land-owner system is based on mutual, oral agreements under the tribe's law without any written documentation of ownership (Fatah et. al, 2004, 3).

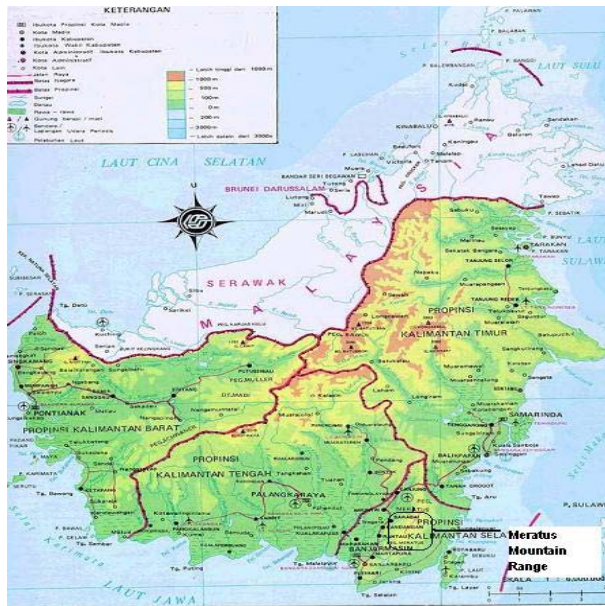


Figure 1.13 The Meratus Mountain Range.

Dayak Meratus Environmental Issues

In principle, the Indonesian Constitution, drafted in 1945, recognises the rights of Indigenous peoples. Yet in practice Indigenous rights have been limited. The first law marginalising the Dayak people was Agrarian Basic Law No. 50, enacted in 1960. It recognises Indigenous rights only if those rights do not conflict with national interests. The Suharto regime used this law to confiscate Dayak territory by issuing timber concessions to local and foreign investors and allowing export-oriented logging in the mountains. Then, in 1979, the regime replaced traditional leaders by implementing a system whereby Indigenous leaders were appointed by the national government. This impacted the Dayak call for self governance (Masian, 2000, 1). The Dayak have since resisted de-

38 Hulu Sungai Tengah, Hulu Sungai Utara, Hulu Sungai Selatan, Tabalong, Kotabaru, Tanah Laut, Banjar, and Tapin.

39 The Meratus Mountain Range remains protected according to Indonesian Government Regulation No. 3/1993 and the Provincial Regional and Spatial Planning (RTRWP) South Kalimantan, which reiterated in 1998 that this area is a protected forest (Fatah et al., 2004, 1).

40 The Dayak Meratus consist of 115 communities and they are a part of the other Dayak tribes who occupy Kalimantan, Sabah, Serawak and Brunei Darussalam. The whole Dayak tribe's population is estimated at about four million.

velopment projects, which have been partly financed with foreign loans. They have been forced to cede land to investors, after which all of the plants and sacred places have been demolished and replaced by palm oil trees.⁴¹ A decentralised system was introduced after the fall of Suharto but there were problems in the transition to decentralisation, which again impacted the Dayak Meratus people.⁴² The status of the Meratus Mountains was changed from a protected forest to a production forest and a Dayak organisation, the South Kalimantan Dayak Consultative Council⁴³, threatened to take action if the logging companies tried to move in. Local NGOs and the Meratus Alliance joined to support the local people (Walhi, 2003, 1).

The Dayak Meratus people have also faced problems regarding mining by foreign companies. In 2001, several foreign companies⁴⁴ proposed opening protected areas to open-pit gold mining. The Dayak Meratus communities sent a letter of objection to the president of Indonesia pointing out that according to Forestry Law No 41/1999, it is prohibited to operate open-pit mining in forests with a protected status (Coumans, 2003). In 2004, the House of Representatives endorsed a controversial regulation in lieu of law (Perpu) that allows a number of mining firms to resume operations in protected forests.⁴⁵ Critics described the move as a reflection of the government's lack of concern for the country's virgin forests. After a fierce debate, 131 legislators decided to support the regulation, while 102 legislators voted against it. To facilitate implementation of the regulation, the government issued Decree No. 41/2004 in May 2004 to allow 13 mining firms to operate in protected forests.⁴⁶ This meant foreign companies could mine in the Meratus Mountain Range. The Dayak Meratus will be affected by the new mining activities. They will likely lose access to their land, which has supported their lives, not only physically but also emotionally. They now have to struggle with the uncertainty caused by external factors such as international trade and national policies.

Linking the Dayak to the WTO

For a country like Indonesia, development is a significant activity. It leads to economic growth and allows the country to prove its sovereignty as an independent nation. However, Indonesia is still considered a developing country. Participation in the World Trade Organisation is expected to accelerate development by expanding the market for Indonesian products. Indonesia is known as an exporter of forest products. In order to increase trade volume, new forest areas are being exploited. This changing land use – from for-

⁴¹ Despite the fall of the Suharto regime in 1998, the marginalisation process has continued. Timber operators often log beyond the limits of their concessions, impacting the rights of the Dayak people living in the area (McCarthy, 2004, 1208).

⁴² For example, there was a dispute in 1999 between the governor of South Kalimantan province and the heads of two districts over the issuing of logging licences by the governor to Korean timber companies.

⁴³ Lembaga Musyawarah Masyarakat Dayak Kalsel.

⁴⁴ Placer Dome Company (Canada), PT Pelsart Tambang Kencana, and PT Interex Sacra Raya

⁴⁵ The regulation allows open-pit mining in protected forests as long as the mining companies concerned have signed contracts with the government prior to the enactment of Forestry Law No. 41/1999.

⁴⁶ These issuances are controversial with respect to national environmental policy as regulated under Law no. 23/1997.

estry concessions to mining to activities such as infrastructure construction, continue to impact the Dayak people. New businesses have created more jobs for the Dayak and increased their economic well-being, yet it is necessary to ensure the Dayak people will get equal access to the benefits of developments on their land. It is difficult to find a direct connection between the WTO and the Dayak people. Further research must be done in this area. We assume that activities in the Dayak territory that are focused on increasing national trade volume will have both positive and negative impacts on the Dayak. The Indonesian government may use trade liberalisation enabled by the WTO to increase economic activities and to achieve short-term economic goals by relying on foreign investments. As an organisation of ongoing negotiations and agreements, the WTO is open to changes in its provisions. We see that within the WTO there may be an opportunity to place Indigenous Peoples as equal partners in international trade and investment. Through this case study, we hope to make recommendations for reforming the WTO to include Indigenous Peoples.

The World Trade Organisation (WTO)

The World Trade Organization was formed in 1995 to integrate the provisions of the General Agreement on Tariffs and Trade (GATT)⁴⁷ into one governing body. It was designed to increase world trade volumes and to regulate service trades, intellectual property rights, and investments. The WTO also has a responsibility to promote increased participation of developing countries in the global trading system (Shrybman, 2001). Ideally, trade-related disputes and problems can be solved through WTO agreements. Environmental protection is included within WTO provisions and is mentioned in the preamble, which establishes that the WTO needs to balance trade with sustainable development (Nowlin, 2002, 5). The WTO has 147 members and decisions are typically made by consensus. WTO agreements are the result of negotiations between the members. Using these agreements, WTO members operate a non-discriminatory trading system that states their rights and their obligations. Each country receives guarantees that its exports will be treated fairly and consistently in other countries' markets. Each promises to do the same for imports into its own market. These agreements are ratified in all members' parliaments.⁴⁸ The top-level decision-making body is the WTO Ministerial Conference, which meets at least once every two years. The last meeting was the Fifth Ministerial Conference, it was held in Cancún, Mexico in September 2003. The agenda included negotiations on trade and the environment and on a range of issues identified as important by developing countries (WTO, 2003, 20).⁴⁹

⁴⁷ The GATT was drafted in 1947 to reduce tariffs and other trade barriers in order to promote international trade.

⁴⁸ Important WTO agreements include the Agreement on Technical Barrier to Trade, the Agreement on Agriculture, the Agreement on Sanitary and Phytosanitary, the Agreement on Trade-Related Intellectual Property, the Agreement on Trade-Related Investment Measures, and the agreement on Dispute Settlement procedures (Shrybman, 2001, 8).

⁴⁹ The WTO Committee on Trade and Environment has a mandate to ensure sustainable development in the world trading system. However, there are ongoing discussions about how to balance trade and environment amongst environmentalists, academics, and politicians (Shrybman, 2001, 8).

WTO and Indonesian National Policy

Indonesia has been actively involved in the WTO system since its inception and Indonesian trade is bound by the standards of the WTO. The national government wants to participate in dynamic global trade, so it will balance benefits between international trade and Indigenous peoples, and since Indonesia sees trade and foreign investment as a way to promote development, it draws on natural resource exploitation as part of its development strategy. The Indigenous peoples who rely on these resources experience impacts associated with exploitation activities – as the case of the Dayak people in the Meratus Mountain demonstrates. Indonesia extracts and exports forest products, and this causes some harm to the Dayak people. The Indonesian government is not adequately taking into account issues of Indigenous peoples who live in that area, despite the fact that Indigenous people have been legally recognised under a presidential decree⁵⁰ and by the Ministry of Internal Affairs Regulation No. 3 1997 on the Empowerment, Sustainability and Development of Customs, People's Traditions and Adat Institutions at the Local Government Level. The case of the Dayak land and the issuance of mining permits show that there have been inconsistencies in Indonesian regulations related to exploitation of natural resources. In dealing with disputes that might arise with respect to forest products or mining, perhaps Indonesia could use international bodies like the WTO. International trade agreements within the WTO could be used to boost income and improve the quality of life for Indigenous people.

WTO reform

The WTO has only two categories of traded commodities: industrial goods and agricultural products. Forest products are currently classified as industrial commodities. It may be necessary to include a new classification of natural resources, including forest products (Shimamoto et al., 2004, 32). We propose that such a classification could restrict forest products to those which are not harvested from areas where the Indigenous people live. We also suggest that export tariffs could be adjusted to discourage forest products from being harvested in Indigenous areas. Finally, we propose that the WTO should have a new committee which focuses on the impact of the international trade on the Indigenous people. Through this body, the problems between trade and Indigenous people will be discussed intensively.

1.3.4 Comparison of case studies

In our earlier discussions, we have raised some questions that might be answered at this point. In comparing the WTO and NAFTA, we have considered them as supranational institutions of trade that are redefining political structures on national and local levels. The difference we initially identified is that NAFTA has a more compact geographical area that may contribute to a closer relationship between the signatories and this relationship may also allow for closer alignment of values. From the two cases, we notice that there is a common issue of how the legal definitions of land ownership and sovereignty are interpreted, accepted and enforced. Although the Cree have a legally binding treaty, it has been subject to legal interpretation and varying degrees of enforcement (usually

50 Presidential Decree No. 45 of 1974.

not in the Cree's favour). The Dayak do not have any treaties and the existence of the treaty is an advantage for the Cree because it provides them with legal leverage in many ways. The problems of administering domestic and international laws with respect to the Cree and Dayak peoples reveal an underlying normative question. For the Cree, this question has its roots in the conflict between Indigenous values and Eurocentric (colonist) values. The Dayak case is more complex because the former colonists do not populate Indonesia today. However, the Indonesian government is Eurocentric and this causes conflict with the remaining Indigenous values.

There are other differences in the two cases. For example, there is a difference between how cohesively integrated the Canadian governmental system functions nationally, provincially and locally and how the Indonesian governmental system is in transition as it moves away from the Suharto's regime toward a system of democracy. There is a lack of cohesion and integration in Indonesia. Despite this difference, domestic and international laws that protect Indigenous rights are not being actively honoured in either case. North – South differences are noticed in this comparison. Although the Cree are disadvantaged because they are located in a developed country that is able to promote itself as a protector of Indigenous interests, they are also at an advantage because they have easier access to information and communication tools for connecting with people to gain support. The comparison is useful because it may shed light on ways to improve the Dayak situation in the future. The Cree are also at an advantage because of the geography they enjoy – being closely situated to the signatories of NAFTA. They may be able to reach out in solidarity with citizens in these countries, both for giving and receiving support. Recent Cree successes may be a beneficial example for the Dayak.

1.3.5 Recommendations

Future research: Affects of international trade on indigenous peoples

In this section, we make preliminary suggestions for further research into the affects of international trade agreements on Indigenous peoples. Our first recommendation is to research the specific provisions of NAFTA and the WTO. Research could begin with NAFTA Chapter 11, which provides foreign investors “broad substantive rights and the ability to bring arbitral claims directly against a government before international tribunals” (Friends of the Earth US, Oxfam America, date unknown, 3). This research could focus on how this chapter affects Indigenous rights. One might look at the claims being disputed under Chapter 11 and see if they refer to Indigenous lands. The same line of reasoning could be pursued for WTO provisions. This research might also identify areas where additional provisions might be added to give Indigenous peoples equal authority.⁵¹

Our second recommendation is to expand existing areas of research into governance, compliance and enforcement in order to find ways strengthen obligations to Indigenous rights within international trade agreements. The structures of authority could be studied to find out how existing Indigenous institutions can be strengthened to in order to face

⁵¹ In the case of NAFTA, attention must be given the two side agreements on environment and labour. In the case of the WTO, attention should be given to committees that could be formed.

the increased pressures of development in their territories. An important research question is: How might these new supranational governance structures interact with Indigenous governance? And, in the case of Canada, how should future Indigenous land claims treaties be structured in order to beneficially interact with international trade agreements and supranational organisations?

Third, from an economic perspective, we call for research into what kinds of corporations, from which parts of the world, are developing Indigenous lands and resources. Which resources are being exploited and who benefits? Under which trade agreements does this development occur? With respect to Indigenous peoples, how are they participating in international trade (i.e. what are they trading)? Is their development guided by corporate partnerships? In regard to these partnerships, what is the exchange of benefits? How are these partnerships structured and how are they in the long-term?

A fourth recommendation for research relates to organisation of reform efforts. In order to achieve equal input into international trade agreements, how should Indigenous peoples organise and mobilise to realise the necessary reforms? What are potential methods of agenda setting and venue shopping? The past activities of the Cree may inform this research.

Finally, the Dayak case points to the need to gather baseline data. Currently, there is not enough information available on the Dayak to support the literature-based research we conduct in this essay. This gap is a major obstacle to finding solutions to the problems that the Dayak face. However, there are also other factors, such as language barriers, for researchers to overcome. It is worth noting that although much information is available related to the Cree case, there is still room for expanding existing studies. Since the JBNQA, the Cree have established themselves internationally. Future research into this aspect of the case could pose questions such as: How are the Cree creating new forms of Identity? How are they mobilising? How are they finding areas of common interest with other Indigenous peoples and non-Indigenous peoples to gain support? What is their international agenda and how is it changing? How is their increasing international recognition affecting their authority over their territory? and What are the effects of the new agreement they signed in 2002?

Indigenous Peoples as Equal Partners in International Trade Agreements

The reform of international trade agreements is a major undertaking. However, large changes start with small steps. Our preliminary recommendations start with issues identified in our case studies. We have shown that countries may have problems respecting the rights of the Indigenous peoples within their own borders, and that because international agreements may exceed the provisions of domestic laws, these international agreements are relevant to Indigenous peoples. This relevance could be captured in special guidelines for trade and could amount to the creation of new side-agreements and committees on Indigenous rights. Indigenous participation in such reforms is critical. A goal would be to have Indigenous peoples as sovereign signatories to trade agreements. Interim steps would be to require consultation with Indigenous peoples on trade and to have Indigenous people equally participating in committees. Capacity for this participation, in the form of financial and technical support, could be partially provided by the signatories of the agreements. Provisions for defining land of cultural significance to Indigenous peo-

ples should also be included in reforms. This would reduce the chance that development under trade agreements would hinder traditional Indigenous activities. Furthermore, corporations that undertake development on lands where Indigenous ownership is in question must prove that they have consulted with the Indigenous peoples and that they are respecting Indigenous rights. Harmonisation of domestic laws with international laws may be necessary. Finally, traditional forms of Indigenous governance should be researched and integrated into trade agreements.

1.3.6 Conclusion

The socio-economic improvement of the lives of Indigenous peoples often takes place within a larger discussion about economic development, and more recently, sustainable development and sustainable resource management. In light of this, we question why Indigenous Peoples are not considered in international trade agreements and argue why, from an equity standpoint, they should be. However, we also ask how these concepts are defined and implemented. We have shown that there is a clash of values in this respect. How are Indigenous peoples treated in the context of trade and development? Preferably, they should not be considered a barrier to trade, for example when issues of land and resource ownership are raised, but should be thought of as equal partners. We argue that the close relationship between Indigenous peoples and the environment raises questions about why Indigenous peoples are not considered in trade agreements, whereas the environment is. This argument is furthered by our consideration of international laws that, in our case studies, exceed the reach of domestic laws. We see problems with interpretation, compliance, harmonisation and enforcement. The question of sovereignty remains central – sovereignty between countries but also between Indigenous peoples and countries.

Since new forms of governance are taking shape and their effects on existing governance structures is unknown, Indigenous peoples are now considering their place in those new structures. There may be opportunities to influence the shaping of those structures in ways that are more beneficial to Indigenous interests and values. The question of how international trade agreements affect Indigenous peoples is a complex problem. However, our initial review of literature for the case studies gave positive insights into ways to further research the topic and into how to investigate the possibility of reforming trade agreements to make them more inclusive of Indigenous peoples, both as decision-makers and as beneficiaries of economic and environmental wealth. Our recommendations are very broad and are a preliminary step in promoting change. These recommendations have two key aspects. First, Indigenous peoples must be equal participants in any reforms, both in defining those reforms and implementing them. The signing of new side-agreements and the establishment of committees on Indigenous rights could fill a gap in the existing dialogue about environment and trade. Second, we feel that future research could fruitfully start from a review of the dispute resolution bodies with trade agreements, focusing on the cases brought to the tribunals. We suggest drawing particular attention to the issue of cases involving arbitration over resources and Indigenous ownership of those resources. Overall, we are optimistic that, in raising these questions and bringing them into conscious discussion, we help open the door to change.

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2. Recourse conflicts

2.1 Cost and Compromise: Forest Practices in Washington State

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2.1.1 Introduction

To find the best solution to a complex environmental problem, a decision-maker may rely on tools and techniques that allow him to compare alternative solutions. These tools and techniques, which include specialized computer software, consider multiple environmental and economic criteria for each alternative. Results can be presented in easy-to-read charts and graphs, which are helpful guides in the decision-making process. In this paper, we use a decision support tool, the computer software program, *Definite*, to apply three decision support techniques to a real life case study. The case study is a decision taken in 2001 to change forest practices rules in Washington State, in the United States (see Figure 2.1). In the case, decision-makers were faced with the environmental problems of declining fish populations and degraded water quality. They considered three policy alternatives, which can be called Historic, Compromise and SuperGreen. A study was conducted to select the best alternative, and the Compromise alternative was chosen. Because that original study compared a limited number of costs and benefits, we wanted to know what would happen if we did a more extensive analysis. Specifically, we were interested in how we could broaden the scope of the original study so that additional monetary and non-monetary factors could be measured side-by-side. This led to our research question:

If more costs and benefits are considered, is the Compromise alternative still the best?

The paper is divided into three parts. In Section 2.1.2, we present an overview of our work. This part includes the context of the case study, a review of the three policy alternatives, and a brief summary of the original study. We also discuss our objectives and methodology, and we explain why it was necessary to make assumptions in order to conduct our analyses. In Section 2.1.3, we present our analysis of the case study alternatives. We begin with a traditional cost-benefit analysis. We then explore how the outcomes change when we include non-monetary values in a multi-criteria analysis. We move on to an extended cost-benefit analysis in which we assign monetary values to factors that were considered non-monetary in the original study. For each technique, we describe our data, methods, assumptions, and results. Finally, in Section 2.1.4, we discuss our conclusions and comment on the usefulness of decision support tools and techniques in general.



Figure 2.1 Maps showing location of Washington state.

2.1.2 Overview

In this part of the paper, we present an overview of our research project. We describe the case study context and outline the policy alternatives considered. We then summarize the original study, which serves as the basis for our work. Next, we review our objectives and our research question. In the methodology section, we link the techniques of cost-benefit analysis, multi-criteria analysis and extended cost-benefit analysis to the case study. Here we identify the criteria we measured with each technique. Finally, we explain our decision to make assumptions in performing our research. The purpose of Section 2.1.2 is to give the reader a general understanding of the scope and depth of our project, as well as its limitations, before we continue with the detailed analysis in Section 2.1.3.

Case Study

Washington state is famous for its stunning natural beauty, its vibrant, diverse economy and its radical political activism. In the 1990s, Washington made headlines again and again – environmentalists chaining themselves to old growth trees, Indian tribes winning treaty rights to water, protestors and police clashing violently on the streets of Seattle. One of the most heated debates was about forest practices, fish populations and water quality. Scientists and environmentalists argued that riparian logging damaged fish habitat and resulted in sediment-clogged streams. The state government was reluctant to act on these claims, concerned about maintaining the viability of the economically and politically important timber industry. To offer an idea of the scale of timber harvest, we provide the map below, which shows the areas available for logging in the past eight years (in black). In 1996, a number of salmon species were listed under the Endangered Species Act. Shortly thereafter, more than 600 streams were identified as water-quality-impaired under the Clean Water Act. These findings forced major stakeholders to the negotiating table. Timber companies, Tribes, environmental organizations and state and federal government agencies struggled to draft new forest practices rules.⁵² Some environmental organizations and Tribes withdrew before the negotiations ended. Those who

⁵² It should be noted that the forest practices rules only pertain to non-federal forestlands in the state. That is, they apply to all state-owned and privately owned forestland.

remained reached an agreement that would become the Compromise alternative considered in this paper.

Alternatives

Although many alternatives were considered during the forest practices negotiations, only three made it to the final stage. The first alternative, which we call the Historic alternative, is simply business-as-usual. In this alternative, riparian logging practices⁵³ would have continued according to the old Forest Practices Act, which required only a minimal riparian buffer and allowed logging throughout the buffer. Because of the reasons outlined in the previous section, this alternative was no longer politically viable. The second alternative, which we call the Compromise alternative, emerged from the negotiations as the preferred policy choice. In this alternative, a minimum riparian buffer zone is required along all streams and some logging is allowed in middle and outer areas of the buffer. The Compromise alternative became a law after it was approved by the state Forest Practices Board in 2001. The third alternative, which we refer to as the SuperGreen alternative, is a compilation of pieces of various proposals put forward by environmental groups and Tribes during the negotiations. As the name suggests, this alternative provides a high degree of environmental protection by establishing very wide riparian buffers and prohibiting any logging within the buffers.

Original Study

Before the Compromise alternative became legally enforceable, it was subjected to a cost-effectiveness analysis and a cost-benefit analysis. This is required by Washington code, RCW 34.05.328, which states, “before adopting a rule...an agency shall determine...[that] the probable benefits of the rule are greater than the probable costs...[and] that the rule being adopted is the least burdensome alternative”⁵⁴ A study was therefore conducted to determine if the Compromise alternative was the most cost-effective and if the benefits of the Compromise alternative exceeded its costs. This study, the *Cost Benefit Analysis for New Proposed Forest Practices Rules Implementing the Forests and Fish Report* (Perez-Garcia 2001), forms the basis of our research and we refer to it as the *original study*. Table 2.1 summarizes the results of the original study. The Historic alternative is used as a baseline and the values are measured as net effects over the baseline.⁵⁵ Note that neither analysis required an assessment of the benefits of the SuperGreen alternative.

53 Riparian means the area along a river or stream. In mountainous Washington, logging in riparian areas often means cutting trees on steep slopes. This can cause water quality problems as soil erodes and washes into the water. A riparian buffer zone is typically used for conservation purposes by leaving some of the natural vegetation in place.

54 Roughly translated, the phrase “least burdensome” means that when the chosen alternative is compared with one or more other alternatives, it will be the least costly way to achieve the objective. This is a cost-effectiveness analysis.

55 The original study compares the alternatives by measuring the net change of the Compromise alternative over the Historic alternative, and the net change of the SuperGreen alternative over the Compromise alternative. This focuses the results on the effects of the policy change, with the understanding that Historic alternative is no longer a viable option.

Table 2.1 Results of the original study (summary).

ORIGINAL STUDY	COSTS (net over base)	BENEFITS (net over base)
Historic (baseline)	0	0
Compromise	\$8 billion	\$11 billion
SuperGreen	\$14 billion (at least)	?

Source: Based on Perez-Garcia (2001).

Objectives

As stated in the Introduction, the objective of our research is to expand upon the original study. Our interests as environmental managers explain this objective. Environmental factors are often short-changed in traditional cost-benefit analyses because the values of certain environmental goods and services are not measured. When we reviewed the original study and saw that many environmental criteria had not been used in the final analysis, we wondered about the possibilities of valuing those criteria and about the impact such a valuation might have on the outcome. We thought that the SuperGreen alternative might have performed better if more environmental criteria could have been included. In other words, if more criteria had been considered, the Compromise alternative might not have been the best solution. Furthermore, we wondered about the consequences of assigning monetary values to additional environmental criteria. This line of reasoning led us to our research question: *If more costs and benefits are considered, is the Compromise alternative still the best?*

Methodology

As outlined above, the original study conducted cost-effectiveness and cost-benefit analyses of a limited number of criteria. We aimed to build upon the original study by using more techniques and including more criteria, but we first needed to fully understand the original study. Therefore, we read the original study and several other studies associated with the case, including an environmental impact statement (DNR 2001) and an analysis of the effects of the alternatives on small businesses (Perez-Garcia et al. 2001). We also consulted with the author of the original study and with stakeholders involved in the negotiations. These conversations informed our understanding of the original study and the relevant criteria. In the original study, twenty criteria were identified as potential costs or benefits, but only seven were given monetary values. These seven were compared in the original cost-benefit analysis summarized in Table 2.2. Of the seven, we chose five for our cost-benefit analysis – indicated with an *asterisk* * symbol in Table 2.2. In addition to conducting a cost-benefit analysis, we also did a multi-criteria analysis and an extended cost-benefit analysis. For these analyses, we considered three additional criteria – carbon sequestration, water quality and social dislocation – which we drew from the thirteen non-monetary criteria in the original study.⁵⁶ All of the criteria considered in our analyses are listed in Table 2.3. **Bold** type indicates criteria considered only in multi-criteria and/or extended cost-benefit analyses.

⁵⁶ We selected criteria that we felt had the broadest range of applicability. We were also influenced by our expectations about the availability of data and the need to provide a reasonable basis for our assumptions.

Table 2.2 Summary Table for the Original Study⁵⁷.

Compromise Alternative	Net costs (\$ billion)	Net benefits (\$ billion)
*Foregone timber asset value	2.678	
*Road maintenance, stream crossings	2.13	
*Lost wages	2.903	
Set up costs	0.154	0.154
*Increase in fish population		8.650
*Road construction activity		2.236
Reduced excise tax	1.54	1.54
TOTALS	8.019	11.194

Source: Based on the original study (Perez-Garcia 2001:15)

Table 2.3 Cost and Benefit Criteria Considered in Our Study.

Potential Benefits	Measures and Effects
Improved fishery resource	NPV ⁵⁸ in dollars for the state
Improved carbon sequestration	Not estimated, will increase benefits
Improved water quality	Not estimated, will increase benefits
Employment benefits from road maintenance plans	NPV in dollars for the state
POTENTIAL COSTS	MEASURES AND EFFECTS
Lost revenues due to timber asset retirement	NPV in dollars for the state
Net costs of road planning and maintenance	NPV in dollars for the state
Net income losses due to employment losses.	NPV in dollars for the state
Social dislocation	Not estimated, will add to income loss

Source: Taken from the original study (Perez-Garcia 2001:6).

Assumptions

As we have indicated, we base our research on the original study. Because the objectives of the original study were restricted to the legal requirements for a cost-benefit analysis of the Compromise alternative and a cost-effectiveness analysis comparing the Compromise with another alternative, the benefits of the SuperGreen alternative were never measured. Also, because the original study was commissioned to support a real policy decision, it considered the limited number of costs and benefits for which there was verifiable data.⁵⁹ Thus, the author of the original study was responsible for conducting a sci-

⁵⁷ In the original study, values for lost wages, increase in fish population, and road construction, as well as the totals, were given in ranges. In order to simplify our research, we used averages of the original value ranges. Also, we excluded set-up costs and reduced excise tax because they are equally costs and benefits (they benefit one stakeholder at the expense of another in an equal proportion) and therefore result in zero change.

⁵⁸ NPV = net present value.

⁵⁹ The values given to the seven criteria measured in the original study are supported by both primary and secondary data generated by government bodies and previously published work of the author of the original study. This verifiability, and the fact that the original study was commissioned by the state government, gives the original study legitimacy in supporting the state Forest Practices Board's decision to approve and implement the Compromise alternative.

entific study in support of an authentic decision-making process. However, we, the authors of this study, are in a different position. Our work is not bound by the same legal or contractual obligations as the original study. We are free to make assumptions about the possible benefits of the SuperGreen alternative and to expand our analysis to costs and benefits that were not quantified in the original study, provided we can justify our assumptions with reasonable arguments. In the second part of this paper, we present our analyses of the case study alternatives. In the explanation accompanying each analysis, we specifically articulate the assumptions we made in order to reach our results.

2.1.3 Analysis

In this part of the paper, we present our analysis of the case study alternatives. First, we discuss our cost-benefit analysis, which differs from that of the original study because we consider the costs and benefits of both Compromise and SuperGreen alternatives. We then explore how the outcomes change when we include non-monetary values in a multi-criteria analysis. We conclude with an extended cost-benefit analysis in which we assign monetary values to criteria that were considered to have non-monetary values in the original study. For each analysis, we discuss the relevant data, assumptions, and methodology in detail. The discussion also includes attention to standardization, sensitivity analysis and uncertainty analysis. We summarize results at the end of each section and we refer to the appropriate appendices where the results are illustrated in tables, charts and graphs.

Cost-Benefit Analysis

The objective of our cost-benefit analysis was to compare costs and benefits of both the Compromise and SuperGreen alternatives. This is different than the original study, which measured the costs and benefits of only the Compromise alternative. For our cost-benefit analysis, we used the five criteria outlined in Section 2.1.1: foregone timber assets, road maintenance, lost wages, improvement in the fishery resource and increased employment due to road construction. Foregone timber assets, road maintenance and lost wages were counted as costs. Improvement in the fishery resource and increased employment due to road construction were counted as benefits. In order to reach the net present value for each criteria, we considered a 50-year time horizon and we used a discount rate of 5.8%, the same discount rate that was used in the original study. Also, as with the original study, values reflect net changes over the Historic alternative, which is used as a baseline.

We relied on the data in the original study to determine values for each of the five criteria. Here we describe how the author of the original study derived the data he used. Statewide timber asset values were derived by extrapolating the values from a sample of timber parcels surveyed in the Small Business Economic Impact Statement (SBEIS) (Perez-Garcia et al. 2001). Statewide road maintenance values were calculated by extrapolating the values from a sample of road maintenance costs per parcel provided in the SBEIS. The values assigned to lost wages were calculated using multipliers established in 1994 (Conway 1994) to measure the effects of reductions in the timber workforce as a function of reductions of the timber harvest. These multipliers were applied to current employment data for the timber industry. The net present value of improvements

in the fishery resource was calculated using data about the economic value of improvements in the Washington fish population (Layton, Brown and Plummer 1997).⁶⁰ Finally, the values assigned to the employment benefits were derived from the costs of implementing road maintenance plans.



The Quinalt, a fish-bearing river, flows from the Olympic Mountains to the Pacific Ocean.

The data provided in the original study would have allowed us to re-create the cost-benefit analysis of the Compromise alternative, but we wanted to compare both alternatives. Thus, we needed to measure the benefits of the SuperGreen alternative. To do this, we assumed that we could determine the missing values through the use of proportional comparison. We calculated the proportions of the differences in data between the alternatives. This allowed us to enter the costs and benefits of both alternatives into *Definite*. The results of our cost-benefit analysis supported the results of the original study. The difference between the total net present value of costs and benefits of the Compromise alternative is positive, resulting in a net benefit to the state of more than 3 billion dollars. The benefit/cost ratio for the Compromise

alternative is 1.41. The difference between the total net present value of costs and benefits of the SuperGreen alternative is negative, resulting in a net loss to the state of more than five billion dollars. The benefit/cost ratio for the SuperGreen alternative is 0.75. Thus, according to our cost-benefit analysis of both alternatives, the Compromise alternative performs well while the SuperGreen alternative is not economically feasible. See Table 2.4.

Multi-Criteria Analysis

In the cost-benefit analysis described above, we considered only five criteria with direct monetary values. The Compromise alternative performed very well and the SuperGreen alternative did not. A decision-maker using only the cost-benefit analysis to inform their decision could feel very justified in choosing the Compromise alternative. But what if they wanted to have a broader understanding of the two alternatives? We elected to develop a broader understanding of the alternatives by subjecting them to a multi-criteria analysis (MCA). An MCA allows us to compare monetary and non-monetary criteria. For our multi-criteria analysis, we added three non-monetary criteria – water quality, carbon sequestration and social dislocation – to the five criteria we used in the cost-benefit analysis (see Section 2.1.1). Again, we considered a time horizon of 50 years. Thus, our MCA measured the effects of the two alternatives on eight criteria over a 50 year time period.

⁶⁰ This study used the contingent valuation method to determine the values of the fish population in 5% increments and concluded that the first 5% increase was twice as valuable as the next 5% increment.

In order to conduct the MCA, we needed to assign values to each criteria and enter the values into the effects table of *Definite*). We assigned the same monetary values to the first five criteria that we had used in our cost-benefit analysis. We then assigned non-monetary values to the remaining criteria. Unlike the monetary values, which can be measured in units of currency, the values of the non-monetary criteria were assigned using an ordinal scale of plusses (+++) and minuses (---). This scale indicates the degree to which a criteria is positively or negatively affected by a policy alternative. In the following paragraphs, we describe the ordinal value assigned to each of the three non-monetary criteria. We also explain the assumptions we made in order to assign the values.

- **Water Quality**

For the criteria of water quality, we used a scale from zero to three plusses (0/+++). We assumed both alternatives would have a positive impact on water quality. We assigned one plus (+) to the Compromise alternative and three plusses (+++) to the SuperGreen alternative assuming the buffer zones in the SuperGreen alternative are sufficient to reach a very high level of water quality. Our assumptions about water quality are supported by two sources. First, the original study describes the water quality effects of the Compromise alternative on several water quality indicators. Second, the environmental impact statement (DNR 2001) associated with the case study provides a comprehensive summary of the effects of each alternative on water quality.



Anonymous waterfall in the Olympics.

- **Carbon Sequestration**

For the criteria of carbon sequestration, we used a scale from zero to three plusses (0/+++). Here we assumed that because both alternatives require wider riparian buffers and less logging, both alternatives would result in an increase in trees. Because the Compromise alternative will only result in a moderate increase in trees, we assigned it a value of one plus (+). We assigned two plusses (++) to the SuperGreen alternative assuming that the effects would be higher than in the Compromise alternative but would still not reach the highest possible rate of carbon sequestration.

This is because the wider buffer zones would not result in a large increase of new forest, but only in the maintenance of existing forest, allowing for some new growth.

- **Social Dislocation**

For the criteria of social dislocation we used a scale of three minuses to zero (---/0).⁶¹ Because both alternatives increase environmental protection and reduce timber harvest activities, we assumed that each alternative would have a negative effect on this criteria. We assigned a value of one minus (-) to the Compromise alternative and two minuses

⁶¹ It should be noted that social dislocation refers not only to the timber workers who lose their jobs as a result of less logging in riparian zones, but also refers to timber-dependent communities whose livelihoods are disrupted on a large scale, leading to high rates of unemployment and regional economic decline.

(--) to the SuperGreen alternative. We assumed that under the SuperGreen alternative the effect of social dislocation would be higher than under the Compromise alternative, but that it would not reach the highest value of the scale because individuals and communities affected by changes in forest practices were awarded some financial compensation and had access to special services.

In order to compare the non-monetary and monetary values, it was necessary to standardize the values. The *Definite* program offers several choices for standardization. We chose to use the Goal Standardization for all of the criteria. In general, goal standardization assigns a one (1) to the ideal or goal value and a zero (0) to the worst value, then scales the scores between these two values. When criteria are standardized in this way, we can see how they compare with one another and with the goal.⁶² We used goal standardization as follows. For the monetary criteria we gave a score of zero (0) to the lowest value in the effects table and a score of one (1) to the highest value in the effects table. For carbon sequestration and water quality, we fixed a range between a goal value of three plusses (+++) and a worst value of zero (0). For dislocation, we fixed a range between a goal value of zero (0) and a worst value of three minuses (---). Standardizing the values in this way allowed us to proceed with our comparative analysis.

To further assist the analysis, we used a hierarchical structure in which the eight criteria were grouped into three broad categories: Economic, Socio-Economic and Environment. The use of categories in *Definite* allows the user to experiment with prioritizing the results to reflect different perspectives. This is helpful because decision-makers must often consider the effects of the policy alternatives on various stakeholders. In the case study, the primary concerns of stakeholders were the economic and environmental effects of the two alternatives. We felt that their economic concerns could be subdivided into purely economic effects, such as lost timber revenue, and economic effects with a human dimension, such as social dislocation. In light of these stakeholder concerns, we grouped the criteria as follows. Foregone timber assets and road maintenance costs were included in the Economic category. Lost wages, social dislocation, and employment benefits were included in the Socio-economic category. The remaining criteria – improved fishery resource, water quality, and carbon sequestration – were included in the Environment category.

After standardizing the values and grouping the criteria into categories, our next step was to assign weights. Assigning weights allows decision-makers to compare the consequences of policy alternatives when viewed from different perspectives. We decided to assign weights based on our understanding of the priorities stakeholders had in the case study. Our literature review and our conversations with stakeholders informed our decision. When assigning the weights in *Definite*, we used a method of direct assessment with a hierarchical structure. We first gave weights to the criteria under each category (Level 2) and then to each category (Level 1). We obtained the final weight by multiply-

⁶² If we had used maximum standardization, for example, we would have given a score of 1 to monetary values that are very different. For example, if one effect has a value of 2 billion, being the highest for that criterion, it will get a value of 1. The same value of 1 could be given to the highest monetary value of another effect on the table. As a consequence 2 billion and 12.35 billion could have had the same value of 1, although this is obviously not comparable in practical terms.

ing Level 2 and Level 1 weights. This method is called weighted summation. In this method, the weights must add up to 1. The Economic category was given the highest weight, 0.40, followed by the Environment category, 0.39, and the Socio-Economic, 0.21. Within each category the highest weights were given to forgone timber assets (Economic), lost wages/employment benefits (Socio-economic), and improved fishery resource (Environment). The results are illustrated in Figure 2.2.

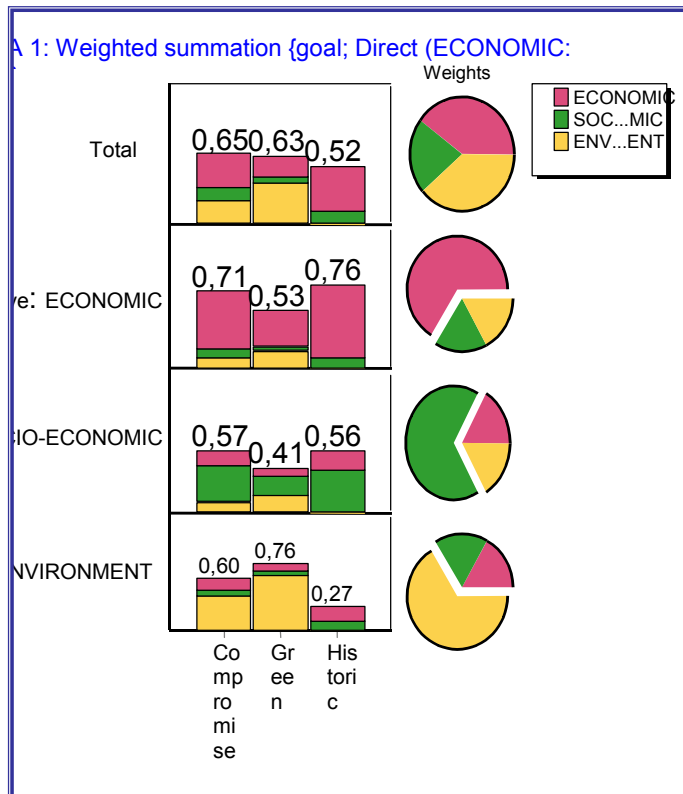


Figure 2.2 Results of the Multi-Criteria Analysis.

According to the results of the weighted analysis, the Compromise alternative, which received a total score of 0.65, was slightly better than the SuperGreen alternative, which received a total score of 0.63. However, we observed significant differences when we considered the scores of the alternatives in relation to the different priorities (perspectives). The Compromise alternative scored well from an economic perspective (0.71), but poorly from an environmental perspective (0.60). The SuperGreen alternative scored very well from an environmental perspective (0.76), but it scored badly from a socio-economic perspective (0.41). Based on these results, we could see that a multi-criteria analysis that measures both monetary and non-monetary values provided a more comprehensive picture of the two alternatives than the cost-benefit analysis we presented in Section 2.1.2. The Compromise alternative still scored the highest overall, suggesting that it is better than the SuperGreen alternative even when more criteria are considered. However, the findings at this point were only preliminary, and the strength of the results needed to be tested by conducting sensitivity and uncertainty analyses.

A sensitivity and uncertainty analyses allow us to determine the robustness of our results (see also van Herwijnen and Janssen 2004). In a sensitivity analysis, the user experiments with weights and scores and observes how the total ranking of the alternatives

changes. This analysis is useful to a decision-maker who would like to know more about the influence or vulnerability of certain priorities. In our sensitivity analysis, we found that regardless of how we varied the weights and scores, the Compromise alternative usually received the highest total score. Conversely, the SuperGreen alternative received a lower score except in the case of extremely high weight given to the environmental perspective.

In an uncertainty analysis, the user assigns degrees or percentages of uncertainty to the criteria and observes how the ranking of the alternatives changes. This is useful to a decision-maker who is uncertain about the values given to certain criteria. For example, in our uncertainty analysis, we were very uncertain that either the Compromise or the SuperGreen alternative would meet the goal of increasing the fish population, so we assigned 100% uncertainty to the fish resource criteria. Overall, our uncertainty analysis revealed results similar to the sensitivity analysis. Regardless of the uncertainty percentages we used, the Compromise alternative had the highest probability of being ranked first.

Extended Cost-Benefit Analysis

The multi-criteria analysis described above demonstrated the usefulness of measuring both monetary and non-monetary values when assessing the performance of policy alternatives. However, in many circumstances decision-makers need estimates of the monetary values of all the criteria under consideration. For example, in the case study, using a monetary value for social dislocation might have led to a more persuasive argument about the real costs, therefore supporting the Compromise alternative. However, using a monetary value for carbon sequestration might have led to a more persuasive argument about the real benefits, therefore supporting the SuperGreen alternative. The desire of decision-makers to quantify all criteria in monetary terms leads environmental economists to assign monetary values to criteria that have traditionally been considered non-monetary. This type of analysis is called an extended cost-benefit analysis. Because the ranking of the Compromise and SuperGreen alternatives in the multi-criteria analysis resulted in similar final scores, we decided to conduct an extended cost-benefit analysis.

In order to do an extended cost-benefit analysis, we needed to assign monetary values to the three criteria that we had considered as non-monetary in the multi-criteria analysis. Unfortunately, we were not able to derive a monetary value for one of the criteria: water quality. Therefore, we proceeded with our extended cost-benefit analysis by considering only seven criteria: foregone timber assets, lost wages, road maintenance costs, employment benefits due to road construction, improved fishery resource, carbon sequestration, and social dislocation. Of these, the first three were considered costs and the remaining four were considered benefits. Because we already had monetary values for the first five criteria from our previous cost-benefit analysis, we only needed to assign monetary values to the criteria of carbon sequestration and social dislocation. We assigned these values as follows:

- **Social Dislocation**

We assumed that the effect of social dislocation would be a cost for both alternatives. We then assumed an annual value of \$11,700 per dislocated timber worker. This value is derived from a study that estimated the average unemployment benefit for dislocated

workers in Washington state to be \$225 per week (Employment Security Department 1998). For the Compromise alternative, we used the employment information in the SBEIS (Perez-Garcia et al. 2001) to calculate the total values. For the SuperGreen alternative, we assumed the number of workers affected would increase in equal proportion. Because we thought it was highly unrealistic to extend the annual figure over a 50-year time horizon, we limited the values to the first two years following implementation of the new forest practices rules. This was based on conversations with stakeholders about dislocated timber workers and on the fact that unemployment benefits in the United States are typically available for up to two years.

- Carbon Sequestration

In order to calculate a monetary value for carbon sequestration, we had to use a combination of assumptions and formulas. We assumed that carbon sequestration would be a benefit in both alternatives. We then did an internet search to find a general formula for calculating carbon sequestration based on tree density per hectare. We used data from the US Forest Service⁶³ and the environmental impact statement (DNR 2001) for the case study to determine the average tree density associated with each alternative. Based on this data, we assumed 100 trees per hectare (ha) for the Historic alternative, 400 trees/ha for the Compromise alternative and 679 trees/ha for the SuperGreen alternative. The amount of carbon sequestered was assumed to be 11 tons CO₂ equivalent/ha/yr. (see Goosen *et al.* 2004). The price was assumed to be 0,02 USD per kg of CO₂ equivalent (see Costanza *et al.* 1997).

After assigning monetary values to the criteria of social dislocation and carbon sequestration, we continued with the extended cost-benefit analysis. In this analysis, we used a 50-year time horizon and a discount rate of 5.8%. Again, the Historic alternative served as a baseline. Despite inclusion of the new criteria, the overall outcome did not change. The net present value of the Compromise alternative remained positive. The net benefit for the state is more than 4.5 billion dollars (about 1.5 billion dollars higher than in the original study). The benefit/cost ratio for the Compromise alternative is 1.56. This is far above the threshold of economic feasibility (1.0). The difference between the total net present value of costs and benefits of the SuperGreen alternative is negative, resulting in a net loss to the state of nearly three billion dollars. The benefit/cost ratio for the SuperGreen alternative is 0.86. Thus, after extending the analysis to include monetary values for the additional criteria, the results show that the Compromise alternative is economically feasible and the SuperGreen alternative is not. These results are consistent with outcomes of both our initial cost-benefit analysis and our multi-criteria analysis. A comparison of our cost-benefit analysis and our extended cost-benefit analysis for the two alternatives is presented in Table 2.4.

⁶³ Forest data from the US Forest Service for Washington state was found at [http://www.dnr.wa.gov/htdocs/rp/for health/2003fhhighlights/fhgencondinter.html](http://www.dnr.wa.gov/htdocs/rp/for%20health/2003fhhighlights/fhgencondinter.html).

Table 2.4 Comparison of CBA and Extended CBA.

	CBA	Extended CBA
Compromise Alternative		
NPV (billion dollars):	3.167	4.518
Benefit Cost Ratio:	1.41	1.56
SuperGreen Alternative		
NPV (billion dollars):	-5.084	-2.881
Benefit Cost Ratio:	0.75	0.86

NPV = Net Present Value

2.1.4 Conclusions

The case study analyzed in our research was a decision taken in 2001 to change forest practices rules in Washington state. The impetus for change came on several fronts, including the listing of salmon species as endangered, the classification of streams as water-quality impaired, and the scientific evidence that forest practices negatively affected fish habitat and water quality. Over several years of negotiations, stakeholders debated alternative solutions to these environmental problems. They agreed on a compromise solution that they felt balanced the most important economic and environmental interests. After decision-makers had selected this compromise as the best policy choice, it was subjected to cost-effectiveness and cost-benefit analyses. These analyses were outlined in a study that compared the preferred alternative with a baseline business-as-usual alternative and an environmentally favorable alternative. We called these alternatives Compromise, Historic and SuperGreen. The original study considered a limited number of costs and benefits, and concluded that the Compromise alternative was the best. We wondered if the outcome would change if more costs and benefits were considered. This led to our research question:

- If more costs and benefits are considered, is the Compromise alternative still the best?

We used a decision support tool, *Definite*, and three decision support techniques to help us answer this question. We conducted a cost-benefit analysis, a multi-criteria analysis, and an extended cost-benefit analysis. In the cost-benefit analysis, we compared monetary values of five criteria for both alternatives. Our results showed that the Compromise alternative was economically feasible while the SuperGreen alternative was not. We then added three additional criteria with non-monetary values, and compared all eight criteria in a multi-criteria analysis. The Compromise alternative again emerged as the best alternative (0.65), although in this case it scored only slightly better than the SuperGreen alternative (0.63). Finally, we compared seven criteria with monetary values in an extended cost-benefit analysis. The results supported the conclusion reached in the original study – the Compromise alternative is the best overall choice. Furthermore, our results suggested that although the SuperGreen alternative achieves greater environmental benefits than the Compromise alternative, these benefits are at the margins of environmental improvement and do not justify the substantial increase in costs. Thus, the answer to our research question is:

Yes, if more costs and benefits are considered, the Compromise alternative is still the best.

There are several possible explanations for the strength of the Compromise alternative. First, it was the result of stakeholder negotiations. This meant it reflected, to some degree, stakeholder agreement on economic and environmental interests. If it had greatly favored one interest group over another, it would not have become the preferred alternative. Also, the Compromise alternative was contrasted with an alternative that achieved only slightly better environmental benefits at a much higher cost. This comparison between more reasonable and less reasonable policy options was bound to strengthen the more reasonable one. Finally, we felt that a great deal of the strength of the Compromise alternative lay in its context – forest practices rules in Washington state. Despite the problems described in this report, Washington's natural resources are very well-managed when compared to the rest of the world. In fact, much of the state's famous natural beauty has been preserved in national parks, and many consider the state to have the most progressive environmental policies in the entire US. In this context, the Compromise alternative cost-effectively achieves benefits at the margins of environmental improvement. This conclusion led us to conduct an additional multi-criteria analysis, in which we tested the Compromise and SuperGreen alternatives in a context with fewer environmental restrictions.

Decision-makers who must choose between alternative ways to solve complex environmental problems, like the declining fish populations and degraded water quality in the case study, need practical tools to support them in the decision-making process. Decision support tools and techniques allow comparisons of alternative solutions to the environmental problem at hand. In applying such tools and techniques in our work, we found that they had both advantages and disadvantages in relation to the case study. The primary advantages were 1) the chance to develop a broader understanding of the alternatives by comparing monetary and non-monetary criteria, and 2) the ability to weight criteria and rank alternatives according to stakeholder preferences. The primary disadvantages were 1) the need to make many assumptions⁶⁴, and 2) the possibility that political priorities will exercise a greater influence over the outcome of the analyses than the tools and techniques themselves. However, as long as users are aware of these disadvantages, they should feel confident in applying the tools and techniques considered in our study to support environmental decision-making.

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⁶⁴ This makes our results less credible than those generated by analyses of entirely verifiable data.

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2.2 Sustainable financing for marine protected areas

Lessons from Indonesian MPAs, Case studies: Komodo and Ujung Kulon National Parks. Authors Viviana Lujan Gallegos, Anu Vaahtera, Esther Wolfs.

2.2.1 Introduction

Irregular and inadequate financing for recurrent costs is a generic and almost global problem for protected areas. Sustainable financing for the conservation of protected areas is an economical approach in the search of solutions to this problem.

Our focus is on Indonesian protected areas, most of which are poorly resourced, some receiving no regular budgets at all, and are reliant on supplementary donor financing, which covers only a limited time period. The number of parks and the amount of funding from donors and government budgetary allocations through the late 1980s and 1990s increased until the economic crisis struck in 1997 (Sumardja 2003). The economic crisis precipitated the May 1998 resignation of the Suharto regime that had been in power for over 30 years. The administration of B.J. Habibie presided over a freely contested election and the formulation of new legislation for more popular control of natural resources.

These events – dramatic, and on a national scale – have had an impact on the national parks that makes us reconsider the adequacy of current financing mechanisms. Currently, the democratically elected Wahid administration is implementing a policy of decentralization and regional autonomy, which started in January 2001 (Haeruman 2001).

In this paper we will analyze the sustainable finance strategy of Marine Protected Areas (MPAs). We will compare two MPAs to identify if they have developed a sustainably financed portfolio of revenue sources. The two MPAs are the Komodo National Park and Ujung Kulon National Park. To perform this analysis we will define sustainable financing of an MPA as well as its main components.

Our approach analyzes what combinations of financing mechanisms can contribute to a sustainable finance strategy. For that purpose we will develop a set of indicators to measure the sustainability of a finance strategy of Marine Protected Areas. These indicators will serve as the independent variable in the research. In this sense, we will analyse the financial mechanisms of the Komodo National Park with the hypothesis that it has a sustainable finance strategy. Thus, the combination of financial mechanisms of Komodo National Park, will be treated as the dependent variables. We assume that those dependent variables positively contribute to the fulfilment of our developed indicators. Finally, we will analyse the current financial mechanisms of Ujung Kulon National Park and obtain information about the contribution of those mechanisms to the achievement of a sustainable finance strategy. The hypothesis for Ujung Kulon National Park is that it does not have a sustainable financial strategy. We assume that a sustainable finance strategy of a Marine Protected Area supports sustainable development for that area and its social, economic and ecological surroundings.

The comparison of Komodo National Park and Ujung Kulon National Park is used because they have common features for the purpose of this research. They are both national parks located in Indonesia and they are Marine Protected Areas. They have World Heritage Site status and are rich in biodiversity (Marine Protected Areas in South East Asia 2005). Komodo National Park has, among other marine life, rich coral reefs, dugongs, sperm whales, blue whales, and turtles and Ujung Kulon National Park has also a diverse marine life, including rich coral reefs, green and hawksbill turtles, and estuarine crocodiles. Both parks strive for the same goal, to address threats to marine biodiversity by professionalizing existing tourism services and developing new tourism products (World Heritage 2005).

This paper is divided into five sections. Section 2.2.1 gives a definition of sustainable financing, with a specific focus on MPAs, as well as a description of the main possible financing components, which combined could form a sustainable financing strategy. Section 2.2.2 elaborates on the indicators of sustainable financing. The third and fourth sections analyze Komodo and Ujung Kulon National Park, respectively, according to their financial mechanisms and their relation to the indicators. Finally, the conclusions and recommendations from the research will be presented and discussed in Section 2.2.5. This last section will also conclude on the sustainability of the Parks' financial structure.

2.2.2 Sustainable financing mechanisms

Definition

The concept of sustainable financing is primarily connected to the management of natural resources. The term is not used in the business field and should not be confused with financing sustainability in either of its forms: investment funds on social responsible enterprises, corporate social responsibility or sustainable banking. The use of the concept of sustainable financing varies from seeking global financial security to collecting user fees in natural parks. Below we try to present different definitions and main characteristics of the concept, to conclude with a definition we propose and which will be used in this paper.

In practice the concept of sustainable financing is applied to correct for the problem of a lack of funding for the conservation and management of natural resources. In most countries, natural resources are a public good, which makes them susceptible to the problem of free-riding. Free-riding occurs when the conservation of a protected area generates costs which are not covered by the beneficiaries of the ecological services. In this sense, the government, the local communities, and the international community are all beneficiaries of the goods from protected areas, but the costs are distributed in an unequal way (Emmerton 2003). This is especially true for Marine Protected Areas, where the control of access and the collection of fees are more difficult and where the livelihoods of local communities depend on the use of the natural resources, especially fisheries.

To address the above mentioned problem, sustainable financing mechanisms help conservation managers meet the cash flow requirements of management operations. This takes into account the varying and diverse financial requirements of management activities to achieve specific objectives. The core elements of sustainable financing are the development of financial management skills; the continued availability of funds; the diversity of funding sources; and the transparency and accountability in the management of the resources, both financial and natural (SEACAM 2001, 6).

The objective of sustainable financing is to create a more predictable cash flow. This could be achieved by designing diversified income streams, which reduce the reliance of a management authority on a single source of income, and are a key source of improved sustainability. Increased administrative efficiency – reducing the unit costs of management activities, is also an option. Cost-effective linkage between the income and the activities to address key management challenges and good governance characteristics are of critical importance. Finally, incentives for local institutions to manage activities and budgets in a more cash-sustainable manner can also enhance the revenues. These options are not mutually exclusive and could deliver more sustainable results if combined (SEACAM 2001, 13).

As our general definition, we understand sustainable financing as a portfolio of diverse and stable financial mechanisms that contribute to the conservation of protected areas, covering operational and other costs with a combined option of short and long-term revenues. A sustainable financing strategy addresses the problem of a government's inability to cope with the necessary funds for the protection of their natural resources, and should involve all stakeholders that either benefit or suffer from an area's ecological services and conservation.

Sustainable financing in Marine Protected Areas (MPAs)

Sustainable financing mechanisms serve different purposes for MPAs. They can provide economic incentives, increase the cost effectiveness of management, support compatible enterprise development to provide alternative income to local communities, and generate incentives and resources for conservation. They can also generate the essential income for monitoring and operation (Domeier 2002).

Effective management of MPAs through sustainable financing mechanisms aims to preserve the biodiversity of marine and coastal species. For this purpose it also entails developing a sense of ownership over the resource as well as products and livelihood alternatives that support marine conservation (WCPA).

Finance Mechanisms

MPA goods and services have considerable economic benefits but also costs. An MPA needs to diversify revenues using a range of financial mechanisms and approaches in order to generate stable, predictable and sustained income for conservation. Relying on one or a few sources of revenue is not sufficient to overcome the effects of fluctuations in income flows. The focus of marine conservation of MPAs⁶⁵ in this paper is on revenue-raising mechanisms, not money-saving activities or economic incentive mechanisms. The mechanisms are categorized under three levels – international, national and local (United Nations Atlas of the Ocean 2005). Within each level the financing mechanisms are subdivided by their source of revenue. The mechanisms are demonstrated in Table 2.5.

It should be mentioned that the possibility of applying the following financial instruments will depend on the specific characteristics of the MPA. Also, it is not necessary to put all of them in practice to achieve sustainability, but it is important to have a diverse portfolio that covers both the short and long-term. Nevertheless, having in place different mechanisms does not guarantee the sustainability of the financial strategy, other aspects such as legal, social and environmental issues should also be taken into consideration. The following section will elaborate on the different indicators that could be used to determine the sustainability of a financial strategy.

⁶⁵ In Indonesia, conservation organizations such as the CCIF and TNC are testing the concept in the marine environment. TNC is developing an eco-tourism concession through a joint venture with an Indonesian company, Putri Naga Komodo, which will operate in and around Komodo National Park.

Table 2.5 Finance mechanisms on international, national and local level.

Level	Mechanism
International	Multilateral development banks ⁶⁶ . Grants and donations from bilateral and multilateral donor agencies, foundations, NGOs, private sector companies, and individuals ⁶⁷ . Environmental funds (endowment funds, sinking funds, revolving funds) ⁶⁸ . Debt relief mechanisms or debt-for-nature swaps ⁶⁹ .
National	Taxes, earmarked taxes, interest-bearing government bonds ⁷⁰ , airport passenger fees and cruise ship passenger fees, hotel taxes and fines ⁷¹ . Real estate tax surcharges especially at the coast ⁷² . Special governmental projects such as funding of earmarked projects; competitive grants, lotteries, stamps etc ⁷³ . Private sector investments; business planning, venture capital investments, concession arrangements, private sector management of protected areas, voluntary contributions, charitable donations and green funds ⁷⁴ . Fishing industry revenue; fishing payments, license fees, excise taxes and fines ⁷⁵ .

⁶⁶ United Nations Atlas of the Ocean 2005.

⁶⁷ Quintela et al. 2004.

⁶⁸ Quintela et al. 2004.

⁶⁹ The debt-for-nature swap is a financial mechanism that has enabled developing countries to spend money on environmental activities which they would otherwise have had to use to repay their foreign debt. Four types of debt relief mechanisms have provided funding for the environment: commercial debt-for-nature swaps, secondary market sales of commercial debt donated by commercial banks to NGOs, bilateral debt reduction programs, and Heavily Indebted Poor Country (HIPC) debt relief. In a commercial debt for-nature swap, a conservation organization purchases debt owed by a debtor country at a discount in the secondary debt market (in some cases, commercial banks have donated debt to conservation organizations). The conservation organization then negotiates with the debtor country government for cancellation of the debt in exchange for payment in local currency or bonds, which is used to implement agreed-upon environmental activities. The debt was sold at a discounted price on the secondary debt market to generate funding for conservation projects. Bilateral debt reduction programs involve cancellation of debt owed by one government to another. The principle is the same: the creditor government agrees to cancel debt, in exchange for the debtor government's agreement to spend an amount of local currency on environmental activities that is equivalent to a portion of the face value of the original debt or to debt service payments (interest and/or principle) (Spergel and Moye 2004).

⁷⁰ These can either be general obligation bonds, which are repaid out of the government's future tax revenues; or special revenue bonds, which will be repaid out of charges and revenues generated by the specific project that is being financed; or bonds that are a hybrid of these two types. U.S. private investors are willing to buy these bonds, which offer lower than current market rates of interest, because the interest earned is exempt from U.S. taxes. (Quintela et al. 2004).

⁷¹ Spergel and Moye 2004.

⁷² Spergel and Moye 2004.

⁷³ Spergel and Moye 2004.

⁷⁴ Spergel and Moye 2004.

⁷⁵ Spergel and Moye 2004.

Local	Community-based initiatives such as hunting concessions and sustainable resource use ⁷⁶ . Marketing ecosystem services; selling carbon offsets, payments for watershed services and protection against storms and coastal erosion ⁷⁷ . Tourism-based revenues; user fees, entry fees, commercial activities of protected area agencies ⁷⁸ and voluntary donations of tourism operators or tourists ⁷⁹ .
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2.2.3 Indicators of sustainable financing

One of the characteristics of sustainable financing is that a portfolio of revenue sources should be built that creates a stable revenue stream for the MPA. Another characteristic is the way the resources and the biodiversity are managed by an MPA and how the park's management deals with conflicts and reacts to surprises. Therefore, we considered it necessary to develop indicators of sustainable financing, based on the literature of sustainable development and of the financing of MPAs.

The following indicators (see Table 2.6) are not given as a set of complete and definite criteria to evaluate sustainable financing, but as a guideline to analyze our case studies only. The indicators were created from the point of view of MPAs in developing countries surrounded by poor communities with a pressure on biodiversity. The case studies in the following two sections, Komodo National Park and Ujung Kulon National Park, will be analyzed and compared according to these indicators.

Table 2.6 Indicators for sustainable financing.

Type of indicator	Description
Financial	Existence of a state-of-the-art business plan. The idea is that this business plan systematically could evaluate the long-term financial needs for operating MPAs and protecting the marine resources, as well as the possible financing options. Development of a portfolio of sources of financing. The different sources should cover both short and long-term needs (Quintela et al. 2004). Accountability. Ideally, the management creates the possibility of a financial independent evaluation of the execution of the funds (Subijanto 2002). Stability of the revenues. The combined revenues should have some independency from global and national economic, political and natural conditions (Spergel and Moye 2004). Balance between costs and benefits. The revenues generated are ideally worth the cost of setting up the new financing system and cover the costs of the MPA (Spergel and Moye 2004; Emmerton 2003).

⁷⁶ Quintela et al. 2004, United Nations Atlas of the Oceans 2005

⁷⁷ Quintela et al. 2004.

⁷⁸ One of the concepts is to lease concessions for the lodges, restaurants, and stores inside protected areas out to private operators (Spergel and Moye 2004).

⁷⁹ Quintela et al. 2004.

	Cost sharing among the beneficiaries. It is desired that the beneficiaries of the benefits of the park bear the costs (Haerumans 2001).
Legal	The existing legal framework may support the finance options. The existing legal framework should allow new financing mechanisms to be created (Spergel and Moye 2004).
	There is a binding body of regulations for nature protection for an MPA. Legally enforceable regulatory instruments help to protect the biodiversity of the MPA (Subijanto 2002).
Administrative	Reinvestment of the revenues in the MPA. Money generated by different revenue sources of an MPA should preferably be reinvested in that MPA (Spergel and Moye 2004).
	Improved management of the park is. With the financial mechanisms the administration of an MPA and its operations should strive to improve towards a more efficient and cost-effective protection of the MPA (Spergel and Moye 2004).
	Role and responsibility of stakeholders in park management. At best, each stakeholder, from donors to managers, to community users of the resources, has a clear role and clear responsibilities in the management of the MPA (Spergel and Moye 2004).
Social	Support from local communities. It would be optimal if communities perceived the financing structure as a benefit for their development (Spergel and Moye 2004).
	Portion of revenues assigned to local development. Ideally, funds will be applied equitably, being sensitive to distributional and wealth transfer issues where conservation needs restrict access to the resources by local communities (Quintela et al. 2004).
	Promote sustainable livelihoods. The financial mechanisms should develop a sense of ownership over the resources or products and promote livelihood alternatives that support marine conservation (Spergel and Moye 2004).
	Capacity building of all the participating actors. Education and training for the actors in order to participate in and benefit from the financial structure can be important (Quintela et al. 2004).
Political	Government support. It is beneficial if government supports the introduction of the new financing mechanisms and that it would be open to innovative ideas for MPA management (Spergel and Moye 2004).
	Flexibility in the renovation of policies and legislation to adapt new finance strategies. Flexibility and adaptability of the government and institutions play an important role (Quintela et al. 2004).
	Independence from political changes. The stability of the financial mechanisms should strive to the highest possible degree of independence from political instability (Spergel and Moye. 2004).
Environmental	Support the conservation and protection of marine and coastal resources. The new financing mechanisms help to protect and conserve its marine and coastal resources, while influencing the continued revenues from different sources (Haeruman 2001).
	Promote research for conservation. In the financing strategy ideally there are funds allocated to research on the MPA for conservation (Quintela et al. 2004).

New financing mechanisms do not have negative effects on the environment. The new financing mechanisms should aim for a minimum compromise to the conservation objectives but should not exceed the carrying capacity of the MPA (Spergel and Moyer 2004).

2.2.4 Case study: Komodo National Park

Komodo National Park is located in the southeast part of the Indonesian archipelago, between the islands of Sumbawa and Flores. Komodo National Park includes three major islands: Komodo, Rinca and Padar, as well as numerous smaller islands creating a total surface area of 1,817 km² (marine and land). The total population currently living in the Park is 3,267 people spread out over four settlements, whilst 16,816 people live in the area immediately surrounding the Park. The majority are fishermen. (Komodo National Park 2005)

Established in 1980, Komodo National Park is a UNESCO World Heritage Site and a Man and Biosphere Reserve (1986). Komodo is known for the endangered Komodo dragon and contains an important marine reserve with more than 1,000 species of tropical fish, invertebrates and mammals (World Heritage 2005).

The goal of Komodo National Park is to protect its biodiversity, particularly the Komodo dragon. Specifically for the marine component the objective is to protect the breeding stocks of commercial fish for replenishment of surrounding fishing grounds (Subijanto 2002). The park has a significant recreational value and receives 20,000-25,000 visitors per year (TNC 2004, 16).



Figure 2.3 Map of Komodo National Park. (Dive The World 2004).

General information on Indonesian finance structures

The government of Indonesia, supported by the World Bank, developed an Integrated Conservation and Development Project (ICDP). This project applies to a diverse range of initiatives with the common goal of linking biodiversity conservation in protected areas with local social and economic development (Sumardja 2003). The total governmental annual investment in protected areas from 1992 – 1997 was in the range of US\$22 – 33 million, of which foreign donors contributed approximately 15% – 20% (World Bank 2001). The number of parks and the amount of funding from donors and government budgetary allocations through the late 1980s and 1990s increased until the 1997 economic crisis.

Components of the financial structure of Komodo National Park

In 2000, the overall budget of Komodo National Park was US\$ 67,085 with 96 staff (Sumardja 2003). According to Merkl et al. (2003) Komodo National Park needs an average endowment of \$32 per hectare (NPV). Traditionally, most of the Komodo trust funds came from the Government of Indonesia. At the moment Komodo National Park was selected by the Ministry of Finance to take part in a pilot project of new financing mechanisms (Komodo National Park 2005). This project is also enhanced by the work of TNC which is promoting, together with other actors, the establishment of a collaborative management of the park (TNC 2005). In this section, the financial mechanisms, as well as the cooperative management program will be explained.

Collaborative management

The Collaborative Management Initiative aims to enhance the role and responsibility of the various stakeholders in the management of the park, gain the support of local communities, and ensure the effectiveness and sustainability of the long-term management of Komodo National Park (TNC, 2004). The main parties involved are the Park Authority, the local government, TNC, a Joint Venture between the TNC and an Indonesian Tourism Company, as well as local communities, government agencies and private sector organizations (Subijanto 2002). The Collaborative Management Initiative was formalized in November 2003 through an agreement between the Komodo National Park authority and the joint venture (Mous 2004).

TNC and the government, via the Directorate General for Forest Conservation and Nature Protection, concluded in 2000, a 25-year management plan in which eco-tourism is viewed as the best strategy to achieve self-sustainability for the park (Subijanto 2002). This management plan provides the legal framework for the regulation of all activities in the park.

Financing mechanisms of Komodo National Park

Below is a description of the different financial mechanisms of Komodo National Park. They are described following the characterizations presented in Section 2.2.1.

- International level

A grant from the Global Environment Facility (GEF) was approved in 2001 to help to bridge the difference between revenue collected from fees and other funding sources over the next seven years (Quintela et al. 2004; World Bank 2001). At the end of the

seven-year GEF grant period, it is expected that the park will be self-financing on an operational budget of US\$2 million per year (Mous 2004). The project has an input from the GEF of US\$ 5.35 million. As co-financers, TNC is contributing US\$ 4.90 million and expected park revenue is US\$ 6.70 million. In this grant there are different components, including promoting sustainable livelihoods and scoping of alternative livelihoods (World Bank 2001).

The investment from TNC and partners in Komodo National Park for the period of 2000-2005 was US\$ 10 million for park financing, such as eco-tourism development, trust fund and collaborative management, and community enterprise development. The investments for 2005-2010 will be another US\$ 3 million to continue to build local capacity (Djohani 2003).

Another international source of funding is the 2002 donation from the United Nations Foundation together with United Nations Environment Program (UNEP), the United Nations Education, Science and Cultural Organisation (UNESCO) and RARE Center for Tropical Conservation, to six World Heritage Sites (both Komodo and Ujung Kulon National Parks are included) US\$1 million project linking environmental conservation and tourism (UNEP 2002).

- National level

The Directorate General of Protection and Nature Conservation in Indonesia gave the national park budget priority among many other programs. The financial resources for national parks in Indonesia came in 2000 from the national development budget, the national routine budget and foreign aid (Sumardja 2003).

- Local level

As of 2004, the entrance fee was collected by the Komodo National Park authority. This revenue is then shared and distributed to government institutions. However, the amount of annual budget allocated for the Park is determined by the Ministries of Forestry and Finance apart from the park's revenues shared to central government (Mous 2004). According to TNC, part of their new financing strategy is to increase the revenue from park entrance fees and user fees for selected activities. Other sources of revenues are conservation fees, diving-pass and hiking-pass fees. A big part of these revenues will be used to support park initiatives such as enforcement, zoning, monitoring, and staff training (TNC 2005; Djohani 2003).

The 25-year management plan established an Eco-tourism Concession for generating revenues for the park in an environmentally sound, socially responsible and economically viable way. This will be carried out by a joint venture between TNC and an Indonesian tourism company. This joint venture has applied for a 30-year concession to manage tourism and eventually will cover the cost of park operations (Subijanto 2002). In this sense, the collaborative management agreement can be seen as the governance structure for park management, while the tourism concession represents the financial management. The tourism concession would be responsible for setting and collecting entrance fees, investing in park infrastructure, licensing dive operations and marketing the park (Djohani 2005; Spergel and Moye 2004).

As part of the GEF project, there is also the creation of a micro-enterprise fund for local family-based business and a community development grant system. They are intended as

an incentive to ensure the sustainable use and protection of the resources by the local communities, by promoting sustainable livelihoods (World Bank 2001; Subijanto 2002).

Licensing fees are collected as well. Dive operators have to pay a diving license in order to take tourists on diving excursions inside the park boundaries (Haeruman 2001). The scuba diving operators also sponsor reef patrolling (UNEP 2001). Cruise boats, sea safari boats, and local wooden boats pay boat-licensing fees (Djohani 2003).

Finally, there are revenues from the visitor centers, such as revenues from souvenirs, restaurants and accommodation.

Analysis of indicators

Based on the indicators described in Section 2.2.2 and the previous description of the financing components of Komodo National Park, we will now analyze if Komodo National Park fulfils the indicators of a sustainable financing strategy.

Financial

Komodo National Park has strong financial indicators. There is a business plan designed for a Network of MPAs in Southeast Asia including Komodo National Park (Merkl et al. 2003). Komodo National Park has a specific 25-year management plan and a portfolio of diverse sources of financing which covers both short and long-term needs. The long-term goal is to achieve Komodo National Park's self-sustainability from the tourism revenues. This objective would be facilitated by the grant from the GEF (Djohani 2005). The different sources are also arranged in a way that allows accountability. The government, public financial auditors, and international organizations such as the IUCN and UNESCO, will periodically conduct independent evaluations on the tourism concession's performance. The goal of these audits is to ensure compliance with agreements and biodiversity conservation benchmarks (Subijanto 2002). The beneficiary pays principle seems partially achieved as the government provides funding, the international community contributes via the World Bank, tourists pay different kinds of fees, and the local community contributes by complying with regulations and conservation of resources. What is not so well defined is if all the beneficiaries pay the fair amount for what they enjoy and if the cost-bearers are compensated for their losses (Emmerton 2003). The denomination of an MPA as a World Heritage Site under UNESCO's list, appeals to international donors and is a tool to strengthen sustainable financing mechanisms (Quintela et al 2004).

This new financing strategy which has a wide variety of mechanisms, attempts to make the park independent from the central government, since it is more related to the direct users and beneficiaries and contracts are signed to guarantee their permanence in time (Haeruman 2001). On the other hand, it is difficult to have a full degree of stability of revenues. Achieving total independence from economic, political and natural conditions is difficult, because terrorism or natural catastrophes cannot be controlled and would affect, for example, tourism generated revenues. It is also difficult to measure if there is a balance between costs and benefits through the whole financing structure.

Legal

There are several key regulations that determine the management and protection of Komodo National Park⁸⁰. A local law regulates the use of fishing gear in the District of Manggarai and inside the Komodo National Park, specifically banning all fishing gear that are potentially destructive. Since 1996, a joint enforcement team has been in place, already showing in 1997 positive results with a 90% reduction of reef blasting (Subijanto 2002). The 25-year management plan is also a source for further park regulations.

National legislation⁸¹ stipulates that all Indonesian National Parks must charge a standardized entrance fee. The government decentralization process allows for innovative financing pilot projects. Additionally, law permits the tourism concession, as long as it includes an Indonesian shareholder, which is the JPU (Subijanto 2002).

Administrative

With the establishment of the joint venture, there is an agreement to reinvest profits and revenues generated from tourism and licensed activities back into the park. The money granted from the GEF goes directly to the collaborative management initiative (World Bank 2001). This also contributes to more effective management of the Komodo National Park. The approach is towards adaptive management according to the use and threats of the resources (Djohani 2005) and this will also enable the park to respond to changes in the political environment (World Bank 2002). Regarding the role and responsibility of the different stakeholders, the GEF grant gives special attention to this issue (World Bank 2001). Nevertheless, it is not clear how these responsibilities are assigned.

Social

Based on the different stated reactions from the communities (Subijanto 2002) it is possible to assume that the majority of the community supports the financial mechanisms. Nevertheless, there is also some resistance to the fact that the TNC as a foreign NGO becomes so involved in the management of the park. Community support is also enforced by the collaborative management initiative, as part of the revenues will serve to train local people as tour and dive guides as well as other activities. There is also space for alternative sources of income (TNC 2005). Currently there are two projects to involve the local communities on mariculture (aquaculture in the sea) and seaweed culture⁸². In addition to this, villagers have expressed their interest to become Park staff and to receive training and assistance for the development of business tourism skills or handicraft making, for example (Subijanto 2002).

80 The Act on Conservation of Biological Resources and their Ecosystems, the Fisheries Law, the Government Regulation concerning Natural Resources Tourism in the Use Zone of National Parks, Community Forest Parks and Natural Resources Parks and Government Regulation on Conservation Areas. The most recent regulations are the Park Zoning issued by the Ministry of Forestry in 2001 and the District Manggarai Regulation No. 11 of 2001.

81 Specifically, UU 20/1997, PP 59/1998, and PP 73/1999.

82 USAID also support pilot seaweed cultivation projects involving 8 communities in and around Komodo National Park (USAID 2005).

Political

The government is undergoing a decentralization process, which allows the new financial and management mechanisms to take place (TNC 2005). Under this development, conservation responsibilities will rely more on local authorities and will require more collaboration with the local governments (World Bank 2001). Nevertheless, it is almost impossible to have a financial structure that is totally independent of political changes, since tourism revenues are affected by political stability and government contributions rely on the economic situation (World Bank 2001).

Environmental

The main objective from the collaborative management, the joint venture, the tourism concession and the GEF grant is to protect and preserve the natural resources and biodiversity of the park (TNC 2005; Subijanto 2002; Djohani 2005; World Bank 2002). Another main target is to reduce destructive fishing practices and poaching. As part of the tourism concession, revenues would also be channeled to research and development of sustainable methods of marine resource use and carrying capacity. This is also related to the possible effects of the new financing mechanisms on the environment.

2.2.5 Case study: Ujung Kulon National Park

Ujung Kulon National Park, located in the extreme southwestern tip of Java on the Sunda shelf, includes the Ujung Kulon peninsula and several offshore islands and encompasses the natural reserve of Krakatau. It contains the largest remaining area of low-land rainforests in the Java plain (UNESCO-WHC). Other habitats in the park consist of swamp, mangrove and beach forest and coral reefs (The Indonesian Nature Conservation Database). Several species of endangered plants and animals can be found there, the Javan rhinoceros being the most seriously under threat (UNESCO-WHC).

This 123,000-hectare park was first protected as a strict nature reserve in 1921 and finally became a national park in 1980 (Wells et al., 1999). In 1992, the Ujung Kulon National Park complex and the Krakatau Islands Nature Reserve were declared a World Heritage Site. Approximately 40% of this territory is marine area (The Indonesian Nature Conservation Database). Ujung Kulon National Park is surrounded by a buffer zone that is inhabited by some 45,000 people residing in 19 villages (Rachmat Hariyadi). The park has significant recreational value and receives 6,500 visitors per year, half of whom are foreigners (UNEP 1991). There was no damage to Ujung Kulon National park caused by the tsunami in 2004 (ICOMOS 2005).



Figure 2.4 Map of Ujung Kulon National Park (WWF).

2.2.6 Components of the financial structure of Ujung Kulon National Park

The financial goal of Ujung Kulon National Park is to build a stronger conservation constituency to protect the park from future threats (UNESCO). In 2000, the overall budget of Ujung Kulon National Park was US\$ 92,000 and the park had 109 employees (Sumardja 2003, 6). Merkl et al. (2003) have calculated that the Ujung Kulon National Park would need an endowment fund of \$79 per hectare to become a sustainable financed national park.

International level

WWF is a close partner to the park and its commitment to protect the remaining 50-60 Javan Rhinos has concurrently increased park funding and capacity. WWF is using the World Heritage status to increase the enthusiasm of donors to help fund their projects in the park (UNESCO-WHC).

The park also gets financial aid from UNDP under the GEF program and the World Bank (The Jakarta Post 2003). UNESCO funds the Ujung Kulon National Park by enhancing site management capacity for using tourism to support conservation; increasing local awareness and support for site conservation; linking tourism marketing strategies

with site and community needs; and promoting the sharing of experience between sites (UNF 2000). Additionally, some international organizations are also active in the park⁸³.

National level

In general, funding for Ujung Kulon National Park comes from central government's budget and there has been little change in park funding since its designation as a World Heritage Site (UNESCO-WHC). See for more information in the Komodo National Park financing mechanisms.

Local level

A program of community-based eco-tourism has been set up for the park (Rachmat Hariyadi). Tours are organized and conducted by trained staff from local communities around the national park. This provides additional income for local people, making it possible for them to avoid extracting natural resources from Ujung Kulon's forests (WWF). The entrance fee to the park is divided among the park management, the provincial government and the central government. It is also possible to buy a package tour or hire a tour guide (Pandaya 2000).

At the local level the park is enhancing community based initiatives. WWF-IP has recently launched a program to stabilize land use and improve living conditions in four villages by developing conservation-based alternative income sources (Wells et al. 1999).

2.2.7 Analysis of indicators

Based on the indicators described in Section 2.2.2 and the previous description of the financing components of Ujung Kulon National Park, we will now analyze the way Ujung Kulon National Park fulfils the indicators of a sustainable financing strategy.

Financial

Although there is no business plan for the park itself, there is a business plan designed for a Network of MPAs in Southeast Indonesia, which includes Ujung Kulon National Park (Merkl et al, 2003). Ujung Kulon National Park also has a management plan that was established in 2000 with a time frame of 20 years. The aim is to include local communities in planning and management of the park. The management plan is the main source of all further processes concerning the Ujung Kulon National Park management (Putro 2001).

The funds channeled into the park have increased but this is largely due to the World Heritage/UNF/UN Environment Programme/Rare projects implemented there (UNESCO-WHC). Ujung Kulon National Park seems to have no focused portfolio of its financing sources. Because there is no clear structure of a finance strategy, the financial

⁸³ International Rhino Foundation, the Asian Rhino Specialist Group and the Rhino Partnership Foundation, WWF Indonesia (The Jakarta Post 2003), the Swedish International Development Cooperation Agency and WWF Sweden (see WWF). The American Association of Zoo Keepers "Bowling for Rhinos" fund-raiser has raised \$180,000 since 1996 to Ujung Kulon National Park entirely through volunteer efforts.

performance of the park seems not to be accountable. Despite the variety of financing mechanisms, they do not seem to generate a stable revenue stream.

In Ujung Kulon National Park the beneficiary pays principle is partly achieved – government and international organisations give funding, tourists pay an entrance fee and the local community contributes to the conservation through alternative income generating sources.

Legal

The same national laws of Indonesia that apply for Komodo National Park also apply for Ujung Kulon National Park. However, the law of a standardized entrance fee does not seem to be implemented in Ujung Kulon National Park. The park authorities enforce the laws and the regulations. There are five marine patrol units to protect marine territory and to prevent illegal entrance. Since the initial implementation in 2002, the coastal patrol has been able to prevent and apprehend several violators, including cyanide and bomb fishermen. The presence of five units of Ujung Kulon coastal patrol has also shown impacts on recovery and re-colonization of coral reefs in certain areas within its marine territories. However this operation is working on a very slender budget and now requires additional financial support to operate fully (UNESCO-WHC).

Administrative

As mentioned before, the park has a participatory management plan (Putro 2001). Assisted by Indonesia's Forestry Department and local NGOs, the site demonstrates participatory planning approaches, innovative training programs for residents and park staff, partnerships with the tourism industry, awareness-raising campaigns for local communities, and financing mechanisms for ongoing site conservation costs (UNEP/ROAP 2002).

The management of the park needs improvements. Many stakeholders such as local government, the National Park Authority, and NGOs such as WWF have tried to suppress the negative interaction between people and the park. Household economy and welfare are identified as the major cause for the negative interaction. Therefore, there should be a clear role and responsibility of stakeholders in park management. Providing sustainable income generating activities is considered as a means for suppressing the negative interaction. To improve the management, staff exchange with the Komodo National Park was initiated. The purpose of this staff exchange was to share lessons learned on park patrolling and enforcement (TNC 2004).

Social

Community based activities in Ujung Kulon National Park seek to design a strategy to physically defend the area, stabilize land use, generate wealth, and transfer it directly to the local people. The work follows the informal and formal structures of the villages and in the future will expand to include fishermen, whose role is presently not emphasized. Currently these operations are already turning a small profit, and with the vision of becoming a sustainable and profitable economic activity, there is need for more financial support (WWF).

The local community is in many ways participating in the conservation of the area. Community participation includes community involvement in the marine patrol units,

also managing and preserving the traditional utilization zone. Communities are also involved in coral farming and transplantation activities (Awriya Ibrahim 2003).

Local people, and often even the local government, lack knowledge and understanding of World Heritage status. In addition to this they did not perceive any direct benefit of obtaining the status. To improve this situation a program of conservation education campaign was initiated by UNESCO-WHC and an NGO. The aim is to build a stronger conservation constituency in support of the park and its efforts to promote conservation. In addition, this will help to protect the park against the threats of unsustainable resource use, population expansion, uncontrolled tourism and other forms of unregulated development. (UNESCO-WHC)

Political

What was already said about the political indicators in the previous section applies also for Ujung Kulon National Park. A noticeable effect of World Heritage status is the adding of weight or influence to political decision-making. The local and central government have supported every policy that came from the management authority to help the protection and conservation in the park, because they know the importance of the park being a World Heritage Site. (UNESCO-WHC)

Environmental

The main source of domestic, agricultural and industrial pollution in Indonesia is Java. The population of eastern Indonesia is estimated to be 35 million. Java and Bali also produce some 70% of the national food supply largely through agriculture. Phosphate and nitrate from agriculture and sediments from logging and conversion of salt marshes and mangroves to rice paddies also flow into the marine estuaries. Land reclamation and other coastal development activities also contribute to poor water quality (Uychiaoco et al.). Other management problems include agricultural encroachment⁸⁴, illegal logging and firewood collection from the heavily populated areas to the east, the threat of rhino poaching and illegal commercial fishing within park boundaries, collection of algae for agar production, and predation of turtle eggs from nesting beaches by monitor lizards and wild boar (UNEP 1991).

The main objectives of the participatory management approach are to promote the conservation and the sustainability of the Ujung Kulon National Park (Putro 2001). There are activities that support the conservation and protection of marine and coastal resources. Monitoring of coral reefs, reef fishes and seaweed is done in several locations in the park. Sustainable use of resources is promoted, such as the use of seaweed in tradi-

84 One of the major threats is encroachment. Most of the local villagers are farmers and fishermen, approximately 30% of the farmers do not own land for farming. Therefore, they work as labourers for the landowners. Furthermore, most farming lands in the buffer zone rely on the rainfall, as they do not have irrigation system to support their farms. In a long dry season, farming becomes somewhat unreliable to support people's economy. Because of (unsustainable agriculture) these difficulties, many people encroach the park and extract natural resources to fulfil their daily needs, or to earn cash by selling it to others. These activities pose a threat for the park, as the extraction is conducted inside the park boundary, thus jeopardizing the existence of biodiversity, and the species within the park (Rachmat Hariyadi).

tional utilization zone (south coast), seaweed farming and the use of artificial reef. Also studies and research are done for conservation purposes. Current studies focus on turtle nesting, heart cockle and soft coral farming which searches for possible rehabilitation methods as well as marketing potentials of soft corals (Awriya Ibrahim 2003).

2.2.8 Conclusions and recommendations

Komodo National Park

It seems that Komodo National Park has a sustainable financing strategy and the park has the potential to receive, from diverse sources, its revenues to create a stable financing stream. One could question the self-generating capacity of Komodo National Park, where the visitors, of which there are few due to recent natural and political disturbances, should generate a large part of the revenues⁸⁵. The GEF and TNC are donating large sums of money to achieve financial independency of Komodo National Park. The development of eco-tourism by concessions and the promoting of sustainable livelihoods of the nearby communities should all contribute to this goal. There is a clear management plan, so accountability should be possible in the future, although responsibilities are not clear. And most beneficiaries participate in the conservation and protection of the biodiversity and resources of the park. Indonesia has several key regulations for conservation of national parks and is showing more flexibility towards earmarking revenues. The enforcement of the regulations in Komodo National Park is operational and has shown positive results. The involvement of the community through training, education, employment and provision of sustainable livelihoods makes them aware of the preciousness and value of the national park.

Ujung Kulon National Park

Ujung Kulon National Park receives donations and help from parties such as WWF and World Bank, but it is not clear exactly what kind of contributions the different parties have and how those contributions are coordinated. The self-generating revenue capacity is low, because the amount of visitors and entry fees asked cannot cover any serious operational costs. The local communities are involved in the activities of the park, including generating some income from the tourism industry. Ujung Kulon National Park has a management plan and is part of the business plan for a network of MPAs.

The enforcement of the regulations in Ujung Kulon National Park is operational and is showing some minor positive results. Unfortunately, the capacity of the current enforcement force is not enough to protect the total area. The entry fees are not earmarked and therefore cannot be used effectively. The management plan has a focus on the training of residents and staff in partnership with the tourism industry and the plan contains the building of support of local communities by community-based initiatives and community based eco-tourism. No clear responsibilities are defined. The awareness of the importance of the national park as a World Heritage Site plays a major role. The goal of Ujung Kulon National Park is to build a stronger conservation constituency to protect the park

⁸⁵ Such as SARS epidemic in 2003, the tsunami in 2004 and the political instability with bombs on Bali and Jakarta.

from future threats, which will be difficult because the park suffers from domestic, agricultural and industrial pollution emanating from Java.

Ujung Kulon National Park has taken the first steps towards sustainability. But after having gone into the details of its management and finance structure, we can conclude that there is need for many improvements. Here we try to outline some recommendations on how to improve the sustainability of Ujung Kulon National Park.

To become more sustainable Ujung Kulon National Park should first achieve some stability of the revenues collected. The entrance fee to the park should be raised at least to the level required by law. Also other fees should be collected, i.e. licensing fees from the scuba diving operators. The revenues should be earmarked so that they remain in the use of the park and not disappear into the central government. Eco-tourism should be further promoted, however, in a way that the increase of tourism takes place under controlled circumstances. This can be reached by organising training in marketing and by expanding the scale and diversity of tourism related operations. Applying for a tourism concession to one of the larger Indonesian tourism operator could positively contribute to this, as can be extracted from the Komodo experience.

Final remarks

Sustainable financing is a new approach to address the management of scarce resources. Komodo National Park has already developed a significant amount of different financing mechanisms to reach self-sustainability. The park has developed a stable economic strategy based on well-managed funds and a diversity of revenue generating mechanisms. Ujung Kulon National Park has taken a big step towards a more sustainable future after being nominated a World Heritage Site. It is expected that in consequence this park will attract more donators and parties willing to cooperate. Ujung Kulon National Park is still far from being self-sustainable and needs to create more and effective mechanisms to be able to create conditions for both nature and the humans to better interact. For both parks, government instability could pose a threat, which should be addressed by the design and implementation of the diverse portfolio of financing mechanisms.

Being a relatively young issue, sustainable financing has developed in a progressive way that can be seen in the steps already taken at Komodo National Park. Nevertheless, other issues such as the need to create a network of MPAs to address the problem of inequity between the different parks should also be considered.

At the national scale, governments need to recognize and accept that conservation and national development are inextricably linked. They should bear the ultimate responsibility of managing protected areas since they are national assets and provide benefits to the nation as a whole. They need to redirect funding in order to increase the financial flows towards environmentally sustainable activities in general and to protected areas in particular. Policy considerations should include provisions that make it easier for protected areas to generate more of their own funding. Luckily, governments are increasingly co-operating with NGOs, the private sector and local communities to finance protected areas. They must also create favorable conditions for such partnerships to emerge and flourish, without compromising their ultimate responsibility to safeguard their countries' protected areas (Quintela et al. 2004).

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2.3 Forest of the Lost Child (Kenya, Africa)

Comparing the applicability of different evaluation methods on a case study in a developing country. Authors Gijsbert Roos, Marije Schaafsma, Adriaan Tas.

2.3.1 Introduction

When an environmental problem is being recognized as such, many evaluation methods are available to support decision-making around the problem. Each method has advantages and disadvantages that are particularly important when one wants to support decision making in a developing country. It has been generally acknowledged that many methods have a Western bias and they are therefore difficult to apply in a developing country context. Moreover, there also seems to be a trend to first pick a method and then fit the problem to it. This seems to be a case of 'putting the cart before the horse'. This study wants to look at a problem first and then try to find a good way to address the problem. The aim is to fit the method to the problem and not the other way around. Taking these considerations into account, the following question is addressed:

Which evaluation method could be best applied to support decision-making in a developing context?

One case study is examined, the Forest of the Lost Child. The forest has been used for centuries by the Loita Maasai in a largely sustainable way. Recently claims by new stakeholders have led to various conflicts. No solution has been found and there is considerable uncertainty about possible management alternatives. The first section of this report addresses the methodology and explains the set-up of the research project. A description is given of the case study, its stakeholders, and three management scenarios. Sections 2.3.4-2.3.6 discuss the evaluation methods assessed in this paper to explain their application and their strengths and weaknesses when applied to the case study. In

Section 2.3.7 we rank the different evaluation methods in relation to this case study. In Section 2.3.8 we discuss the outcomes of the ranking and the possibilities and usefulness of combining different evaluation methods. The last section contains our conclusions.

2.3.2 Methodology

The question at stake in this paper is which evaluation method could best be applied to support decision-making for managing the Forest of the Lost Child. The Forest of the Lost Child has been selected because it is situated in a developing country and because one of the authors has considerable knowledge of the case. Three decision support tools are compared: multi-criteria analysis (MCA), geographical information systems (GIS) and cost-benefit analysis (CBA). The study starts by exploring the problem through a literature review and expert consultation. The case is still in the problem definition phase, which makes it difficult to apply evaluation methods. Therefore, hypothetical management scenarios are formulated. The methods are applied to these alternative scenarios. The purpose is not so much to get valuable results but rather to get insight into the strengths and weaknesses of the different methods.⁸⁷ Eight criteria are used to further guide the analysis: transparency, objectivity, relevance, comprehensiveness and completeness, participation, experience, data load, and operational costs and time. A score is given for each criterion on the basis of expert judgment. The scores are then used as input for a final MCA. The final MCA shows the ‘best’ evaluation method to support decision-making in choosing a management option in the case study.

2.3.3 Case study: The Forest of the Lost Child, Narok District, Kenya

Setting

Situated in the Loita Hills of Narok District in Kenya, the Loita Naimina Enkiyio Forest, also known as the Forest of the Lost Child, covers an area of 330 km². It lies at an average altitude of 2000 m above sea level and the forest is one of the last remaining closed-canopy, truly indigenous forests in Kenya.

Biodiversity

The Naimina Enkiyio forest forms one of the critical dispersal areas required by wildlife populations from the Maasai Mara National Game Reserve. Internationally recognised endangered species are found in the forest and the forest is a key in the conservation of the many species of the Mara region itself. The abundance of different habitats leads to a high diversity of plants and animals. However, wildlife is hard to see, especially compared to other tourism areas in Kenya.

Water catchments

The Naimina Enkiyio forest is one of the main water drainage systems in the region. It is a source of many streams that supply water to associated ecosystems within and outside the forest. Beyond the forest these streams form tributaries of several rivers that drain

⁸⁷ Due to the heavy information burden of GIS we were not able to perform an application of this method.

into the larger Ewuaso Nyiro River, flow through the dry Magadi rangeland ecosystem and provide fresh water sources to breeding flamingos on Lake Natron. The internal drainage system also provides permanent water sources for humans and livestock and is often the only refuge in times of drought.

Maasai communities

The present forest inhabitants are mostly Loita Maasai people. Around 20,000 Loita Maasai live in the forest area (IUCN 2002). The Maasai herd cows, goats, sheep and occasionally donkeys. Traditionally, herding involved a well-organised seasonal migration through the Rift valley. For the Loita Maasai, the Naimina Enkiyio forest is of inestimable value in both their pastoral economy and in their cultural and spiritual life (Kronenburg 2001). The Loita Maasai place great value on the forest as a source of mythology. Cultural leaders reside close to the forest and locations of cultural importance are closely guarded within the forest.

Changes

At first glance there seems to be little reason for intervention in Loita. There is no environmental degradation, no serious degradation of rangelands, no large scale agriculture, no commercial exploitation of the forest resources and no threat to the wildlife. There is still a well-functioning system of social control managing the natural resources (IUCN 2002). However, the situation must be re-examined in the context of emerging challenges both inside and outside the Maasai community. Several changes are taking place in the Loita community, including a shift to a more sedentary way of life and an increasing dependence on forest products concurrent with modernisation. There is growing interest in using the forest for ecotourism,⁸⁸ though only a small proportion of the community benefits from tourist activities. Traditional institutions have trouble adapting to these recent developments and changes in lifestyle may erode traditional resource management systems. New measures are needed.⁸⁹ The IUCN has embarked on a project to sustainably manage the forest and while the local community initially agreed to this, the IUCN has recently faced opposition from certain Maasai groups. The project is now at an impasse.

Management alternatives

There are not yet clear management alternatives for the forest. Hence, we use the following hypothetical alternatives in this paper. In the Base alternative, the Maasai manage the

⁸⁸ In June 1993 the Narok County Council, legal custodian of the forest, announced its intention to turn the forest into a nature reserve, opening it to large-scale commercial tourism. The Loita Maasai objected and formed a company, the Loita Naimina Enkiyio Conservation Trust, which acts as the community's representative. Since 1993, several legal battles have been fought between the Narok County Council and the LNECT over rights to the forest. No final decision has been taken.

⁸⁹ This is recognised by the Loita themselves. "We have now seen that there is a need to have a more organised way to protect the forest", says Raphael Loolpapit. "Now there is a need not just to go with the traditional way of doing things but to create a new forest management policy."

forest. Their interests include dry-season grazing, forest product collection, small-scale tourism, and the cultural values of the forest. They have property rights. In Compromise alternative, which is based on IUCN management proposals, sanctuaries are delineated for conservation purposes and other areas are open to sustainable use by tourists and Maasai. In the Tourism alternative, management would be the responsibility of the County Council and the focus would be the exploitation of the forest for intensive tourism activities. This alternative is based on existing County Council plans⁹⁰ and it would prohibit any use of the forest by the Maasai.

2.3.4 Multi-Criteria Analysis

What is MCA?

Multi-criteria analysis is a set of methods used to compare and rank a discrete and finite set of alternatives. MCA is part of what Colson and Bruyn (1989) define as multi-criteria decision methods, i.e. “a world of concepts, approaches, models and methods to help decision-makers to describe, evaluate, sort, rank, select or reject objects...on the basis of evaluation...according to several criteria” (Colson and Bruyn in Sharifi and van Herwijnen, 2004). An MCA typically consists of the following steps:

- Problem definition – defining alternatives and evaluation criteria, scoring the criteria
- Analysis – standardisation, weighting, ranking
- Uncertainty and sensitivity analysis

MCA has been gaining ground as a tool to support environmental decision-making, mostly in the developed world. This section reviews the steps entailed in an MCA and takes the case study as a starting point. The aim is to gain insight into using the tool in relation to the case study.

Application to the case study

Problem definition

Most literature on MCA is dedicated to analysis, not to problem definition. This is not surprising as each problem is different, but there is a threat that too little attention is given to the problem definition.

Definition of alternatives

An MCA starts with defining possible solutions, i.e. the different alternatives. Three alternatives have been defined for the case study: the Maasai alternative, the Conservation alternative, and the Tourism alternative.

Objectives and evaluation criteria

One advantage of an MCA is that it can deal with various objectives. This makes the tool apparently suitable for the problem at hand because various objectives have been defined

⁹⁰ Note that this alternative is also in the interest of tour operators. Although it has not been made clear who these tour operators are, it might well be either international parties or operators which are located in the capital.

for the forest. To represent all these different objectives, the following criteria were formulated:

- Economic – tourist revenues, job creation, wildlife damage, management costs
- Environmental – biodiversity, water catchments
- Social – self-determinacy, sacred sites, access to forest resources, equity

One of the strengths of an MCA is that it can integrate criteria measured on different scales (including non-monetary scales). For this analysis, it is assumed that stakeholders agree on criteria. In reality, the local government may not consider access to forest resources by the Maasai as a relevant objective.⁹¹

Scoring the criteria

Once criteria are set, they can be scored for each alternative. A clear disadvantage is that scoring the criteria is problematic because uncertainties are brought into the analysis that may be difficult for stakeholders to grasp. In the case study, few data are available to score the criteria. In some instances, guesses based on expert knowledge are necessary. Scores are therefore measured on an ordinal scale.⁹²

Standardisation

Scores from the various effects and criteria can only be compared if the measurement units are the same. Through the standardisation procedure the measurement units are made uniform. Maximum standardisation is used for the criteria in this case study.

Weighting

Weighting is a procedure through which the relative importance of the different criteria is determined. Various methods are available, and in this case study direct weighting is applied. The most important point is that stakeholders hold different perspectives on weights. It is unlikely that stakeholders agree on the relative importance of criteria. This would mean the MCA has to be performed several times to cover different perspectives. For the discussion here, only one (rather arbitrary) weighting is used.

Ranking

There are three broad approaches to ranking alternatives: compensatory methods, out-ranking methods and non-compensatory methods. These methods often represent different approaches to decision making, and choosing among methods may depend on the problem under consideration. It is advisable to start with a relatively simple method, like weighted summation, so participants can focus on the nature of the decision problem and

⁹¹ In that case, we are dealing with what Sharifi and van Herwijnen (2004) call a *division*, i.e. a group that does not agree on the criteria and then it might be possible to execute an MCA for each stakeholder group separately.

⁹² The alternative that scores best gets a 1, the worse alternative gets a 3. However, when these scores are used to make a ranking in DEFINITE, the outcomes are surprising (e.g. in the outcomes the Maasai alternative scores worse when most weight is given to the social criteria). Therefore, in DEFINITE the scores were simply reversed giving a 3 for the best alternative and a 1 for the worse alternative.

can get familiar with the tool. More complicated methods might be applied later if necessary.

Outcomes

The ranking analysis shows that the Maasai alternative scores the highest. The Conservation alternative is second and the Tourism alternative as third best. In this sense, it would be highly desirable for the Maasai communities to come up with their own management plan for the forest. The problem is that within the Maasai community there is no clear institution that holds the legitimacy to take decisions on behalf of the community. Moreover, the community itself is strongly divided and therefore it might be appropriate to design more than one alternative to represent the Maasai community.

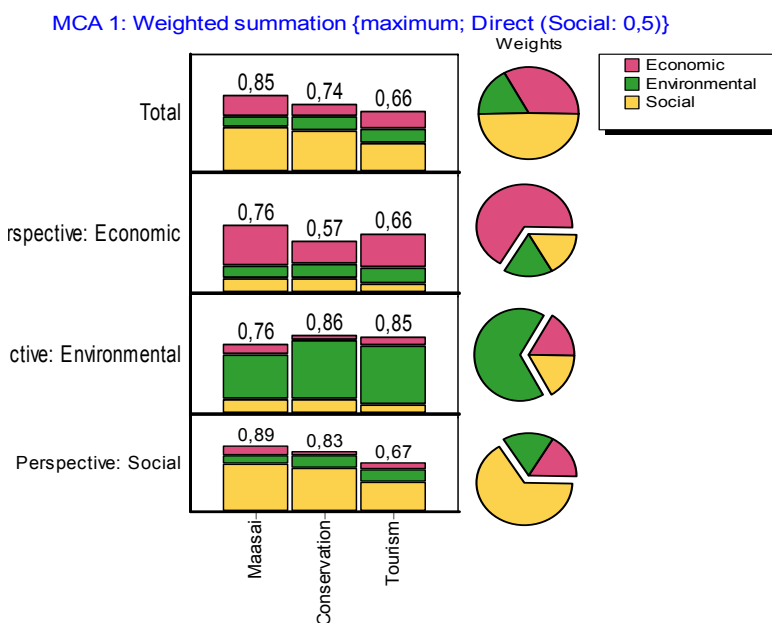


Figure 2.5 Outcomes of ranking analysis (Weighted Summation).

One strength of an MCA is that shows the effects of different perspectives. However, an MCA can only rank alternatives. It does not provide a yardstick to measure overall the performance. An MCA does not indicate feasibility or whether an alternative will benefit all stakeholders. This makes it important for an MCA to take all alternatives into account, so that at least the best alternative is chosen.

Criteria

The following section discusses the strengths and weaknesses of the MCA method. The scoring is based on expert judgement.

Transparency

The actual decision-making process that normally takes place in your mind, is made explicit by doing an MCA, and in that sense it is transparent. There are, however, some drawbacks. It is often not explicit, i.e. transparent, where the scores come from. Also,

standardisation, weighting and ranking procedures are often difficult for laymen to understand.

Score: 6

Objectivity

An MCA implies making assumptions and choosing among methods within the MCA process. Particularly, the fact that different methodological options produce different result and the fact that weighting procedures are inherently subjective reduces the objectivity of the tool. On the other hand, assumptions can be reported and uncertainties and sensitivities can be analysed.

Score: 4

Relevance

An MCA is designed to help decision-makers choose among different alternatives. Therefore the tool seems relevant to the problem under consideration. An MCA makes it possible to take different objectives into consideration and this is valuable for a case study where different stakeholders have different objectives. Yet one should realise that an MCA only makes a ranking and cannot be used as a yardstick. It is not possible to determine if a project is feasible.

Score: 7

Comprehensiveness and Completeness

An MCA makes it easier to include all relevant factors, especially factors that cannot be easily quantified. It should be noted that some factors are scored more easily than others and are therefore more often included in the analysis.

Score: 8

Participation

An MCA offers room for stakeholder participation. Participation is possible in the problem definition phase (except for the scoring), the weighting phase and sometimes in the ranking phase. This does not imply that the participants always understand the methods and procedures.

Score: 8

Experience

To date, there is relatively little use of MCA in developing countries.

Score: 2

Data load

An MCA requires a lot of data. In the case study, many data are not yet available.

Score: 4

Operational cost and time

The process of applying an MCA can be considered rather costly and time consuming, because it requires extensive consultation with stakeholders to set criteria and do the weighting.

Score: 5

2.3.5 Geographical Information Systems

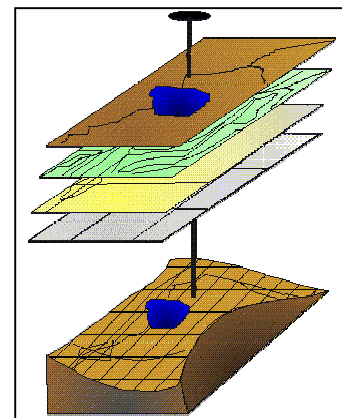
What are Geographical Information Systems?

Spatial information is often critical for decision-making. Geographical Information Systems (GIS) have been developed as one way to address spatial problems. GIS is a decision-support tool that ties together different kinds of geographic data to provide spatial context. An essential part of GIS is spatial analysis, which is needed to turn geographic data into useful information. Spatial analysis can be defined as a set of methods whose results change when the locations of the object being analysed change (Longley *et. al.*, 2001).

How GIS could be used in the case of the Forest of the Lost Child in Kenya

The aim of GIS is to give insight into land use. A map can be produced for every management alternative. Stakeholders provide input as to land use demand; allocations may also be based on expert judgment. The strength of GIS is to overlay maps representing management alternatives. This technique allows stakeholders to see areas of spatial conflict. In the case study, GIS could be applied to the three alternatives. For example, in the Maasai alternative, community needs could be translated into land use classifications, or spatial *hotspots*. However, finding relevant data and converting it into useful information can be a difficult process. One option is to rely on local knowledge. This knowledge can be plotted on maps, which can be digitized and used in GIS. This strategy is called participatory GIS. Another option is remote sensing, which captures spatial relations via aerial photography and satellite imagery. In our case, the government could hire GIS experts to 'build' such a GIS. Satellite images and/or aerial photographs could be used to classify existing land uses (land mapping).

A simple overlay analysis could give insight into the physical areas of conflict after preferred zones are designated by stakeholders. Overlay analysis integrates spatial data with attribute data⁹³ by combining layers. This overlay, or spatial join, can integrate different data. In the case study, several layers could be selected. Maps could be defined according to stakeholder needs. The overlay technique could then provide useful information by combining different maps related to management alternatives. This could provide basic information about optimisation of land use. Moreover, it could be used as input for other evaluation methods, such as MCA or CBA.



⁹³ Attributes are information about each map feature.

Criteria

The following section describes the strengths and weaknesses of GIS qualitatively. The scoring is based on expert judgment.

Transparency

The transparency of GIS is based on presenting the spatial dimension of the forest and the conflicting areas of a management alternative. It gives stakeholders a basis for negotiation rather than showing which management alternative is the best. The visual aspect information makes it more understandable. However, when data are presented in a map, people need to be educated in order to understand the spatial analysis behind it. Moreover, the techniques developed in the North tend to set up a highly sophisticated GIS, which increases the complexity of the whole process of decision-making. If the GIS application is a product of local entities it may create more understanding of the tool's functionality.

Score: 5

Objectivity

Objectivity depends on whether evidence and conclusions can be verified by people other than the GIS users. The GIS product may look fancy, but it relies heavily on the data used. The output quality reflects the input quality. GIS demands a high level of commitment to overcome this problem for users and non-users. The use of GIS to support decision-making can be highly political. GIS input has to be approved and the outcome has to be ratified by decision makers. These individuals must be educated about the use of spatial data and the need to create long-term support among all actors.

Score: 4

Experience

GIS has a wide range of hardware and software available world wide, but it is difficult to choose a package based on the present and future needs in relation to compatibility with other software. Lack of training in spatial analysis limits successful implementation in developing countries. Other problems are a reliable power-supply and availability of local technical support. However, technical support is growing and training is an effective way to foster expertise.

Score: 6

Data Load

Data load is an important aspect to take into account, because the quality and quantity of data is a limiting factor in using GIS. GIS can become complicated because the boundaries to spatial analysis are unlimited. It depends on the project and the capacity of the hardware and software, as well as the knowledge of a GIS-expert. In the case study practically no data are available. The information is present in the form of local knowledge. This information has to be converted into useful data to feed a GIS. This could be done by using simple maps and discussing land use. Remote sensing could be an option, but the cost of collecting and processing high resolution data is prohibitive.

Score: 5

Participation

Participation depends on the stakeholders. These initiatives are undertaken in developing countries to empower users by sharing knowledge and skills. The intensive training requirements may discourage participation. Participation by NGO's and the private sector in the use and production of spatial products needs to be encouraged.

Score: 7

Relevance

GIS can classify land uses of the forest for every management alternative, showing the conflicting areas in a spatially explicit way. It has the power to simplify and facilitate decision-making. In this case, GIS is not very relevant in terms of choosing a management alternative, but it does show conflicting areas in a visual manner and could be used in other phases of the process, such as problem definition, implementation, and evaluation of a specific management alternative.

Score: 5

Completeness and comprehensiveness

The strength of GIS is that it has the capacity to store and combine different datasets. Forest management is an ongoing process, which implies that more and different datasets may give insights into specific situations. Yet data are never entirely accurate or current enough to get the 'right' perspective. This is related to the quality and quantity of the input of relevant stakeholders.

Score: 6

Operational cost and time

How much money and time is needed depends on the scale of the GIS and what the goal is. The operational costs include labour, training, data availability, and maintenance. The operation time relies on the duration of the project. The scope of project in a developing country often depends on the donor. Large investments required in spatial analysis training may not be feasible for short-term projects.

Score: 7

2.3.6 Cost Benefit Analysis

What is CBA?

Cost-benefit analysis (CBA) is a technique that is often used to measure costs and benefits of environmental projects in economic terms. An extended economic CBA can measure financial/economic values, social and/or cultural values and environmental and/or natural values related to a project/policy scenario. It measures direct use values, such as timber harvesting or tourism, but it can also put a monetary value on biodiversity, the existence of wildlife, and ecological services of nature areas. The latter examples are called indirect-use values (ecological services and possible future benefits) and non-use values (existence value). CBA uses many valuation techniques – both market

and non-market.⁹⁴ An issue of debate in CBA is discounting. A discount rate is often applied because consumers are supposed to prefer income generated now over future income generation.⁹⁵ When all present and future benefits and costs of a certain project are calculated, a discount rate can be applied to come to the Net Present Value (NPV) of the project. A positive NPV indicates that a project is worth undertaking. Also, NPVs for alternative projects can be compared to see which is most feasible. A CBA can favour the importance of nature for the economy and the society as a whole. However, for many environmental benefits, markets are nonexistent and therefore these 'benefits' are not counted in macro-economic growth. That is why many environmental benefits and costs are not taken into account by policy makers.

The following steps are taken in conducting a CBA:

1. Problem definition;
2. Definition of effects, criteria and/or value components;
3. Calculate Costs and/or benefits of each effect and/or value component;
4. Calculate Net Present Value of project or scenario.

Application to the case study

In the following paragraphs, we explain the extent to which a CBA might be applied in the case study.

Problem definition

The problem at stake in our case study is the Forest of the Lost Child: who should manage this forest and what are the outcomes of different forest management strategies? A CBA might contribute to the problem definition by estimating the current monetary value of the forest and calculating the costs and benefits of the different management alternatives, but it would not be a useful for problem definition or scenario development without stakeholder analysis.

Definition of effects, criteria and/or value components.

The Forest of the Lost Child has direct-use, indirect use and non-use values. The direct use values are local households' forest use and tourism. Commercial timber exploitation is not economically feasible. The indirect use values are the ecological services, such as water catchments and the habitat functions. The non-use values are those based on moral conviction. This might be animals such as lions and elephants, but also the spiritual and social value for Maasai. Each forest management alternative entails costs, which should be taken into account. For example, if the forest is governed by a conservation regime, there will be opportunity costs for local forest use and agricultural activities. Tourism might also bring environmental damage to the forest.

⁹⁴ When market prices are not available, techniques such as hedonic pricing, the travel cost method and contingent valuation can be used.

⁹⁵ Consumers have a so called decreasing marginal rate of time preference. Another argument for discounting is the opportunity cost of capital.

Calculate Costs and Benefits of the management options and value components.

This step is the calculation of costs and benefits over a certain period of time. Until now, hardly any research has been conducted on the monetary value of different management options in the Loita Forest. To estimate the value components we use other studies conducted in different areas in Kenya and transfer these estimations to our case, adjusting for differences between the sites.⁹⁶

- Benefits

In earlier studies, values for tourism revenues and water catchment have been estimated for the Forest of the Lost Child.⁹⁷ We use data from these studies in our calculations. The other direct use value is local household forest use. A problem is that so called non-timber forest products (NFTP) can be an important form of household income, but cash markets for these products do not exist or are not good indicators of value. Local perceptions of wealth are more important. We draw on studies by Emerton (1996) on the value that local people put on forest resources.⁹⁸ We have little information on the households around the Loita Forest, but we assume that 20,000 individuals equal 4,000 households. The total local household forest use value will then be between US\$0.4-1.6 million dollar.

The other benefits are social and ecological. According to Norton-Griffiths and Southey (1995) the potential of bio-prospecting by pharmaceutical companies in African forests is low, while carbon sequestration values might be very high. The forest also has a high cultural, spiritual value for the Loita Masaai. This value has not been calculated before in any Kenyan forest. Possible methods would be to use local wealth indicators and calculate the value of a certain ritual based on the sacrifices made. Also, one could use the price tourists are willing to pay to attend cultural ceremonies. The recreational value of

⁹⁶ Transferring costs and benefits is only possible if we make some assumptions regarding the characteristics of the site.

⁹⁷ Total tourism related revenues are estimated in the region of KSh 1 million per annum (US\$16,000). The number of visitors per year is approximately 600. The potential tourism revenue is estimated to be KSh 3 million per annum (IUCN 1999). The water catchments value of the forest can be quantified by estimating known benefits e.g., down stream irrigation, or economic benefits derived from the Forest or the costs that arise if the protective function is removed e.g., managing resulting siltation. Loita hills protection value has been estimated at KSh 2520/ha for a total of KSh 105 million (for a watershed area of approximately 41,480 ha). This consists of biomass production, water supply for other fresh water and forest systems and water flow regulation.

⁹⁸ Emerton (1996) studied in Oldonyo Orok Forest in Kenya on the value that local people put on forest resources. The participatory environmental valuation calculations, which use a local wealth indicator that is translated into a monetary amount, indicated subsistence forest use values of about US\$ 100 (KSh 5,000) a year for an average forest-adjacent household, in which water collection and grazing are most important. Emerton (1999b) also refers to other studies in Kenya. Local forest use in Aberdares is worth US\$165 per household; in Arabuko Sokoke it may be US\$135 per household and in Mau Forest US\$350-400 per household.

viewing wildlife elsewhere in Kenya has been calculated.⁹⁹ Based on these estimates, the value of national parks in Kenya lies somewhere between US\$4-8 per hectare and the total value of the Forest of the Lost Child would lie somewhere between US\$14 and US\$26 million dollar. However, as wildlife is not easily seen in the Loita Forest, the value might be lower. To calculate this value one could use contingent valuation studies to estimate the existence value of certain wildlife species in the park according to park visitors.

- Costs

Direct management costs of the Forest of the Lost Child were based on a study of the Mount Kenya Forest (Emerton 1999b). A CBA also takes opportunity costs into account. For example, the Loita Forest under a conservation regime cannot be used for agricultural activities. Drawing on another study of the Mount Kenya Forest Reserve (Emerton 1999a) we estimate that turning the Forest of the Lost Child into a national park would carry opportunity cost of US\$1 million per year. Conservation could additional costs for local communities, such as damage caused by wildlife. We estimate these costs to be US\$ 0.4 million per year.¹⁰⁰ A CBA can also calculate the costs of degradation, but these costs are difficult to estimate; it involves biological indicators to measure the impact on ecosystems of tourism. However, the potential for tourism in the case study forest is probably low. Another pressure is the growing market demand for fuel and construction wood. No studies have yet been conducted to measure these costs.

Calculate the NPV of the different alternatives

Using estimated values, we can execute a partial CBA for the three alternatives. Net Present Value is calculated using a 20 year time horizon and a discount rate of 10%. Many assumptions have to be made. For example, we assume that tourism revenues in alternative 3 are maximised. Also in alternative 3, the Maasai have no access to the park, while in alternative 2 access is limited. Alternative 1 puts pressure on the water catchments due to increased agriculture and population growth. Management costs also depend on the alternative. The Maasai alternative has no costs, while conservation by the government has the highest costs. An important shortcoming is that no monetary value can be put on cultural significance. In the first and third alternatives, the Maasai retain access to spiritual sites. This would add social benefits to these scenarios, which are now undervalued. Taking social benefits into account might lead to a different 'best' alternative. Moreover, this partial CBA does not count damage costs. According to our partial CBA, alternative 3 would be the best from an economic perspective.

⁹⁹ The annual recreational value of wildlife viewing in Lake Nakuru National Park in Kenya was found to be US\$7.5–15 million (Navrud and Mungatana 1994). Emerton (1998) finds that Maasai Mara National Reserve has a value to international tourist of some US\$85 million.

¹⁰⁰ Emerton (1999a) argues that forest conservation does not generate pure benefits for local communities. Forest dwelling wild animals cause damage to trees and crops grown in forest adjacent area, also by transferring diseases, life-stock kills and injury. Emerton (1999b) refers to other studies in Kenya; in the Shimba Hills elephant crop damages was estimated on US\$100 per household.

Criteria

As with the previous evaluation methods, every criterion is given a score between 1 and 10. The scoring is based on expert judgement.

Transparency

A CBA has the advantage of measuring the factors in a single, monetary unit. As economic goals are important to policy makers, expressing value in monetary terms can provide strong arguments for conservation or protection strategies. It also makes comparisons easier. However, economic efficiency is not always socially optimal. Also, and especially in developing countries, cash is not always a good indicator because people may have a different value perception.

Score: 7

Objectivity

The single measurement unit and the absence of ranking or weighting contribute to objectivity. Verification is as easy as reporting the method and the data used. On the other hand, researchers may use different parameters and reach different results. The results might be influenced by the subjective view of the researcher. A CBA can overvalue conservation strategies, but it can also underestimate them when not all values are considered.

Score: 6

Relevance

A CBA can provide arguments for all stakeholders and it might help decision-making in the case study, because it is clear in outlining which alternative is most beneficial. It shows that many environmental values markets could be expanded or developed.¹⁰¹ However, the case study is still in the problem definition phase – this decreases the relevance of a CBA, which is less useful when alternatives are not clearly described. Furthermore, a CBA cannot assess institutional capabilities or community organisation issues and it is also difficult to calculate the variance in costs and benefits over time.

Score: 5

Comprehensiveness and Completeness

A CBA can measure the opportunity cost of conservation, which is often forgotten in other decision support methods. It could also count the benefits of local household forest use. There are disadvantages. Nature areas have benefits outside of the macro-economy that might not be considered. A CBA does not take the distribution of costs and benefits (equity) into account. Conservation might be worth more in total, but certain groups might not benefit at all and compensation plans require trust among stakeholders. Also, a CBA is usually done by experts¹⁰², which makes it harder to explain the outcome and en-

¹⁰¹ Owners of protected areas could ask for compensation for their contribution to watershed protection and hydro-electric power installations. Carbon sequestration could be traded on the international market.

¹⁰² Doing questionnaires among stakeholders is not considered as a participatory method.

sure acceptance of results. Finally, it is difficult to estimate the value of some components, such as biodiversity or spiritual sites.

Score: 5

Participation

A CBA offers few possibilities for participation and this might jeopardise the acceptance of outcomes. Yet participation is an important factor for a CBA in an African context.

Score: 3

Experience

An advantage of the CBA method is its extensive use in both developed and developing countries. For this case study, however, few relevant CBA's are available. The value of ecosystem functionality remains unclear, especially because (ecosystem) benefits sometimes overlap.

Score: 7

Data load

A CBA is often difficult to apply due to a lack of data. The valuation of biodiversity and ecosystem functions is possible, but it depends on site-specific characteristics and calls for precautionary estimations using transfer pricing. It is not easy to use market data because markets in Kenya are not functioning as needed for a CBA.

Score: 4

Practical (costs, time, ethics)

Despite low data availability, a CBA scores well on time and cost issues. However, it has ethical, unquantifiable problems. It is difficult to assign a monetary value to cultural, intrinsic and primary values. In the case study, the spiritual value would be difficult to measure.

Score: 6

2.3.7 Overall Multi-Criteria Analysis

In this section a Multi Criteria Analysis (MCA) is applied to compare the evaluation methods – MCA, GIS, and CBA – and decide which evaluation method is 'best' to support decision-making in choosing a management option in The Forest of the Lost Child.¹⁰³ The 'best' alternative is chosen according to criteria examined in previous sections: transparency, objectivity, relevance, comprehensiveness & completeness, participation, experience, data load, and practical cost, time and ethics. The last two criteria are costs, while the others are benefits. The scores are based on the qualitative analyses presented in previous sections. Maximum standardization is used. Weights represent priorities (preferences). We use pairwise comparison for the weighting, which generates a quantitative ranking through qualitative comparison. The ranking is consistent with the expert judgment used earlier. The weights and the scores of the criteria in relation to the evaluation methods are given in the table below.

¹⁰³ The MCA is run with the software program *DEFINITE 2.0*.

Table 2.7 *Weights and scores of criteria in relation to alternatives (evaluation methods).*

Criteria	Weight	Alternative (score)		
		MCA	GIS	CBA
Transparency	0,131	6	5	7
Objectivity	0,042	3	4	6
Relevance	0,353	8	5	7
C & C *	0,157	8	5	5
Participation	0,182	8	7	3
Experience	0,086	2	6	7
Data load	0,025	4	6	4
Practical cost	0,024	5	7	6

*: Comprehensiveness & Completeness

A ranking was generated in which MCA emerged as the ‘best’ evaluation method (Table 2.8). Additional analyses, including an uncertainty analysis and a sensitivity analysis, support this finding. An MCA appears to be the ‘best’ evaluation method for choosing a managing alternative.

Table 2.8 *Final score alternatives.*

Alternative	Score
MCA	0,86
CBA	0,75
GIS	0,67

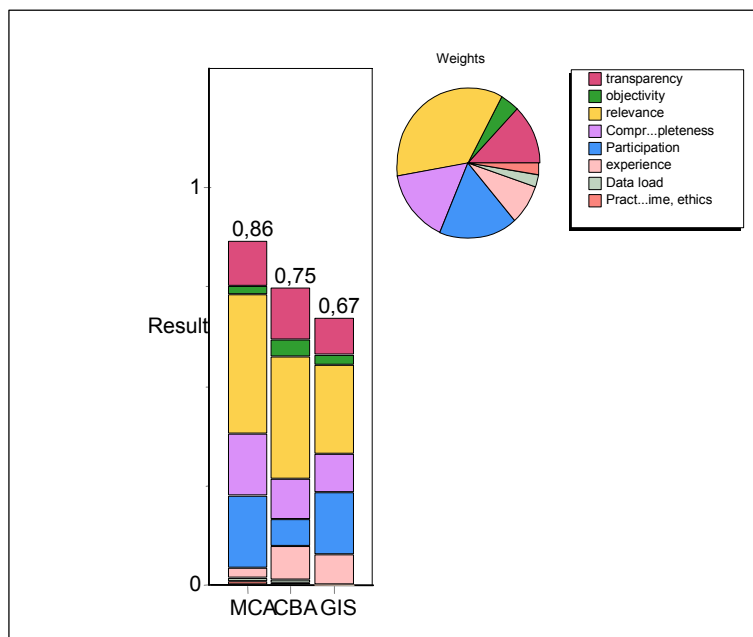


Figure 2.6 *MCA 1: Weighted summation {maximum; Pairw. Comparison (relevance: 0,353)}.*

2.3.8 Discussion

The final MCA in Section 2.3.7 shows that Multi Criteria Analysis will be the ‘best’ evaluation method to support decision making in the case study. However, as clarified in the previous analyses, certain weaknesses remain. Recent research shows a growing focus on combining decision support methods. One tool can compensate for the shortcomings of the other. The problem at stake is land use allocation, which obviously has a spatial component. MCA cannot cover this dimension. GIS, on the other hand, does not provide some tools needed for evaluation involving multiple criteria and conflicting objectives. Combining MCA with GIS could overcome these problems. Van Herwijnen and Janssen (2004) show that this is possible. Experience combining these methods in another case study in Kenya shows that better results will be achieved if the process is carried out iteratively. This gives participants a chance to view preliminary allocations before a final land allocation map is made (Mwasi 2001). Possibilities for participation were also an important reason MCA scored as the best method for our case study. Another case study from Canada shows that combining different methods is necessary to be able to include all aspects of the problem: economical, social, ecological, spatial and temporal (Seely et.al. 2004). Therefore, not only GIS, MCA and CBA are used, but also stakeholder analysis.

In the case of the Forest of the Lost Child, a small stakeholder analysis has been held by IUCN. Stakeholder analysis is useful when the problem is unstructured, the problem affects humans, science is uncertain, stakes are high and decisions urgent, and values and world views differ vastly in different groups of stakeholders (Gupta et.al. 2005). Conducting a detailed stakeholder analysis before an MCA could identify all relevant issues. Application of CBA in the case is only desirable if participation was extensive and if it were possible to assign a monetary value to biological and social criteria. Distributional issues would have to be taken into account. It might be possible to overcome CBA shortcomings by first executing a thorough stakeholder analysis. The spatial component could be included by combining GIS and CBA. However, this is not enough for CBA to prevail over MCA. Finally, even though, the case study has been presented as a structured problem, in reality it is an unstructured problem with many uncertainties. Scientific knowledge and institutional interests are fragmented. This calls for approaches other than analytical tools, like GIS, MCA, or CBA. In such a context, Janssen *et al.* (2004) suggest starting with a policy exercise to clarify goals and objectives, invent strategic alternatives and evaluate those in terms of the values at stake. In the decision-making process there is a need for a method which will support mediation and negotiation. With this kind of problem, effective communication among stakeholders is often the most important means to reach a generally accepted policy decision.

2.3.9 Conclusion

The purpose of this project was to select the ‘best’ evaluation method in the case of The Forest of the Lost Child. Three methods were evaluated according to eight criteria. The scores of each method were based on expert judgment. MCA proved to be the ‘best’ evaluation method to support decision making in choosing a management alternative. MCA scores highest on important evaluation criteria: relevance, participatory possibilities and comprehensiveness and completeness. However, MCA does not provide an ab-

solute performance ranking of the alternatives. Weighting is often regarded as being political and subjective and it does not address spatial aspects of the problem.

A CBA could help to select a management alternative by giving a rather objective outcome expressed in one unit of measurement, but the fact that this case study is situated in a developing country context diminishes a CBA's usefulness. It is almost impossible to put a monetary value on spiritual sites and ecological services are hard to value because knowledge on ecological system dynamics and the impact of environmental change is lacking. Also, many benefits fall outside official markets, especially in the case of local household forest use, and even though estimates can be done using sophisticated CBA techniques, the danger of undervaluation remains. Finally, the problem in this case study might not lie so much in value considerations, but more in institutional strengths and distributional problems. A CBA is not suitable to address these problems.

A GIS analysis is a good way to identify conflicting land use demands. It is a helpful tool for communication and participation, because it can provide clear maps to support stakeholders in discussion and negotiation. However, GIS cannot rank alternatives and is therefore less useful for choosing the best management alternative. Also, GIS proficiency requires training – of technicians as well as policy makers and decision makers. Another important disadvantage is the amount of input data necessary, while in the case study much of this data is unavailable.

To overcome the shortcomings of an MCA, a combination of MCA and GIS is suggested. However, the strongest objection against applying any of the methods above is that the described management alternatives are unclear. It is questionable if all the interests of the stakeholders have been examined and covered. In reality, the case study of the Forest of the Lost Child is still in the problem definition phase and can be characterised as an unstructured problem. In such a complex and uncertain environmental management context, it might be better for the decision making process to start with a policy exercise to clarify goals and objectives, invent strategic alternatives and evaluate those in terms of the values at stake.

2.3.10 References

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Useful links

<http://www.mosaic-conservation.org/gis/index.html>

<http://nativenet.uthscsa.edu/archive/nl/9412/0140.html>

<http://www.ogiek.org/faq/maasai.htm>

3. Economic instruments

3.1 Tax and Subsidy: An alternative market based instrument for improved pollution control.

Author Eric Massey, S&E Associates.

3.1.1 Introduction

The debate over the most effective policy instrument to address pollution control has been long and varied. What now appears to be widely recognized, at least theoretically, is that the use of market based instruments (MBIs) or economic incentives such as taxes, subsidies and permits, are far more superior means for achieving compliance and optimal levels of pollution emissions than command and control measures (Baumol and Oates 1988). Same for specific cases where a pollutant is highly toxic and should be used sparingly, as with the case of lead in gasoline or when the costs of monitoring prove to be too costly, as with ship to sea discharges, the use of MBIs is more cost effective and allows for more freedom and flexibility on the part of the regulating authority as well as the polluter. By normalizing the marginal cost of abatement across all polluters MBIs would appear to encourage a wider use of pollution control options on behalf of firms. Furthermore, it is theorized that MBIs offer a greater incentive to invest in research and development of newer and cleaner technologies.

The question for the regulating authority then becomes, which type of economic instrument is the most effective? To a certain degree this depends on whether the pollutant source is point or non-point, nevertheless the use of taxes and/or permits has received much attention in the literature. What appears to have received quite little notice is the use of a combined tax and subsidy scheme. In this brief paper I would like to introduce such a scheme [based on the articles by Segerson (1988) and Cumberland (1994)] and theoretically describe why a tax-subsidy scheme would be a better alternative to a simple pollution tax given what I perceive are its limitations. I will begin by outlining the basic structure of the simple tax scheme, followed by its limitations. Next I will present my tax-subsidy scheme followed by a discussion of how it improves upon the basic tax scheme.

3.1.2 Standard pollution tax scheme

In theory the principle behind a pollution tax is both simple and elegant, requiring little input by the regulating authority to achieve its desired results. Let us assume that a firm is emitting at an unregulated level of E and the regulating body wishes to have the firm abate. Based upon the marginal damage function (MDF) of the pollutant, the regulating body can overlay the firm's marginal abatement cost function (MAC) with the MDF and derive from their intersection point the economically optimal level of emissions for the firm, E_t . The regulating authority can then correlate a price to E_t and institute a per-unit pollution tax for any emissions at or above E_t (Figure 3.1). Assuming that the firm is rational it will see that to continue emitting at E will be more expensive than paying the

tax at E_t and will abate until its MAC is equal to the tax. While this is the manner in which to derive the economically optimal level of emissions for a firm, the same principle could hold true for achieving legal compliance for the most socially and ecologically optimal level of emissions, for the purposes of simplicity I will call this the “best” level (Massey 2005).

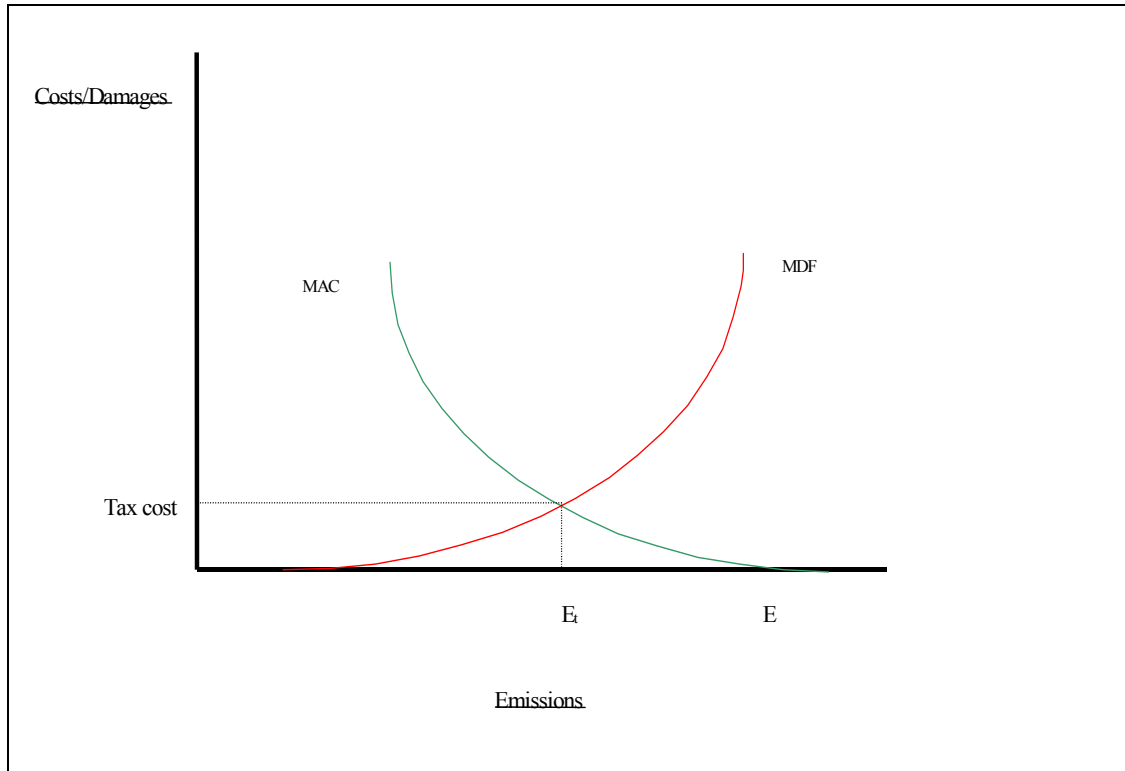


Figure 3.1 Economically optimal tax & emissions level.

Let us assume that the regulating body has decided that the “best” level of emissions is at E_o and it wishes to have the firm abate to that level. As above, it could simply correlate a tax price to E_o and again in theory the firm would respond by shifting its emissions to where its MAC intersects with the tax (Figure 3.2).

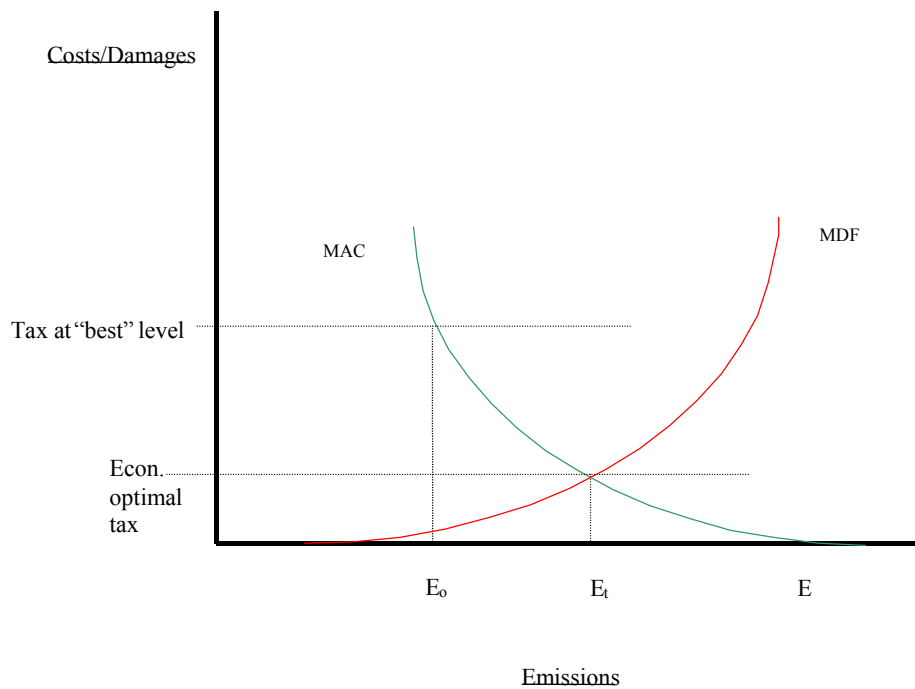


Figure 3.2 Deriving the tax at 'best' level of emissions.

3.1.3 Limitations of the pollution tax scheme

Despite its simplicity and elegance there are several limitations to such a model, based partly upon implicit assumptions to make it work and partly upon other factors. I will begin this section by listing the limitations I see and then addressing them in more detail.

Limitations to the simple tax scheme include:

1. The assumption that the marginal abatement cost functions of firms are known by the regulators;
2. The assumption that firms always act in a rational manner to maximize profits and will respond accordingly to changes in the market place;
3. The assumption that the *economically* best level of emissions as derived from where the MAC and MDF intersect is the *ecologically* and *socially* optimal level of emissions, and if it is not that firms could afford to pay a higher tax to achieve said level;
4. Similar to assumption 2, if firms act rationally then paying the pollution tax will become "a cost of doing business" and firms will have little or no incentive to abate beyond the taxed limit.

The assumption that regulators know the MAC of individual firms or, in the case of multiple firms, the aggregated MAC is probably one of the most important assumptions for allowing the tax scheme to work optimally. If the aggregated MAC is not known, which is usually the case, and an estimate has to be made (Kahn 1995) then the regulating body risks that either the tax is too low and firms will pollute far above the intended level or that the tax is too high and firms will protest against what they see as inordinate demands of the regulators. In both cases the power of such a scheme becomes muted leaving society worse off.

The second assumption that firms will always act in a rational manner and respond accordingly to changes in the market is perhaps a more subtle issue. The tax scheme under neoclassical environmental economics dictates that the polluter will, in order to maximize its profits, shift its marginal abatement costs to where they equal the tax. But as van den Bergh, et al (2000) illustrate, in the real world firms do not always respond to changes in the market place with a neoclassical economic point of view, that in fact if one were to look at firms not from the point of view that they were exercising maximization behavior but instead they acted to increase cost-effectiveness, then the tax scheme might have less than intended results. To illustrate this point, let us assume again that a firm is polluting at an unregulated level of E and a tax is set at E_t . If a firm exhibits cost-effectiveness versus profit maximization in terms of pollution control it could say that the cost of emitting at E is too high but that if it shifted its emissions somewhere between E and E_t it would be more cost effective in operating its business.¹⁰⁴ Without any further incentive other than saving a marginal amount of money it would still be emitting above the intended level set by the regulating authority without any repercussions other than the cost to society.

As we have seen in Figure 3.1, the level of allowable emissions is selected by deciphering where a firm's marginal abatement cost intersects with the marginal damage function. From an economic point of view this is the most efficient means of selecting how much firms ought to pollute. This approach, however, is not free of drawbacks. For example, referring back to Figure 3.2, what if it is scientifically proven that E_o is the socially and ecologically optimal level of emissions, but the slope of the firm's MAC function is such that where it intersects with the MDF is far to the right of E_o , say at E_t , and a tax were set at that level? The firm would be polluting at its most efficient level, however it would be emitting beyond what is scientifically sound. As stated in the previous section, the regulating authority in principle could set a tax at E_o and in principle the firm might abate to that level, but at a higher cost to the firm and ultimately to society. Furthermore, if a tax were set at E_o , there is an assumption from the regulators that the firm could actually afford to pay the tax and emit at E_o , while in reality it might require the firm to invest in newer technologies that it could not afford in order to meet such stringent demands. Therefore, we see a potential disconnect between what is socially optimal and economically feasible.

The last limitation of a tax scheme that I would like to discuss is not based upon an implicit assumption but related more with a firm's environmental stewardship. The purpose of pollution control is to reduce the overall amount of pollutants released into the environment. The more that emissions can be reduced the more society as a whole benefits, at least from the ecological point of view. In this light, pollution control policies and abatement measures should not be seen as static tools. They should be dynamic and always subject to the question, "are we doing the best that we can?". Where the tax scheme falls short on this is that it offers no incentive for firms to perform better. While it does encourage them to emit at a certain level, once that level is reached there is no need, other than perhaps the firm's perception of being an environmental steward, to go

¹⁰⁴ Firms also might not respond to the tax and abate to E_t if they perceive that abating will in some manner affect the quality of their product and would thus prefer to pay than produce what they might see as an inferior good.

beyond the taxed limit. From a neoclassical economic view this is obvious as the cost to abate further is higher than what has been dictated thus it is neither cost-effective nor financially reasonable. Therefore, unless the tax level was constantly shifting, a firm would not invest in newer “greener” technologies even if such technologies were marginally more expensive. In this case, the tax scheme only acts as a partial motivator for better environmental performance.

In the next sections I would like to introduce my tax-subsidy scheme and show how it might address, by way of improvement, the limitations associated with a simple tax scheme as outlined above.

3.1.4 Tax-subsidy scheme

The idea behind a tax-subsidy scheme is rather simple and straightforward, whereby firms are rewarded for good behaviour and penalized for bad. To begin, let us assume that the regulating authority wishes to achieve an overall or mean level of emissions that are socially acceptable and economically achievable. Under my model, which is based on Cumberland (1994), the regulating body instead of fixing a specific target of emissions correlated to a price, sets a range of allowable emissions zones. Plotting limits to these zones on a standard MAC function graph we have E_o , E_t , and E_m (Figure 3.3). In this case, E_o is the ecologically optimal level for pollution emission by firms. It is characterized by high marginal abatement costs and the use of, or investment in, the best available technologies or it requires the invention of new technologies. E_t can be considered the socially acceptable amount of emissions or the mean level of emissions that the regulating body was originally trying to achieve in the standard tax scheme. The cost of reaching this level is lower than E_o and, depending on the firms individual MAC would require less investment in technology. E_m is the upper or maximum allowable amount of emissions and is the least expensive to realize.

Assuming now that a firm is polluting at E_m under this model, if the regulating body wishes to have the firm reduce its emissions to E_t it sets a per-unit charge for pollution levels between E_t and E_m , similar to the simple tax scheme. The incentive here is that the per-unit charge for emissions is greater than the firm's MAC. And thus it will be cheaper to abate. However, once the firm reaches E_t it ceases to pay any charge or tax. In effect the firm can pollute for free (save for paying its marginal abatement costs) as long as it stays at E_t . As stated though, E_o is the most ecologically optimal level to pollute at and the regulating body would like to see as many firms as possible emitting here. However, the costs are prohibitive. In an effort to entice firms to shift from E_t to E_o a per-unit subsidy can be offered to firms that operate within this range. The subsidy, in theory, could be used by firms for capital investments in new technologies.

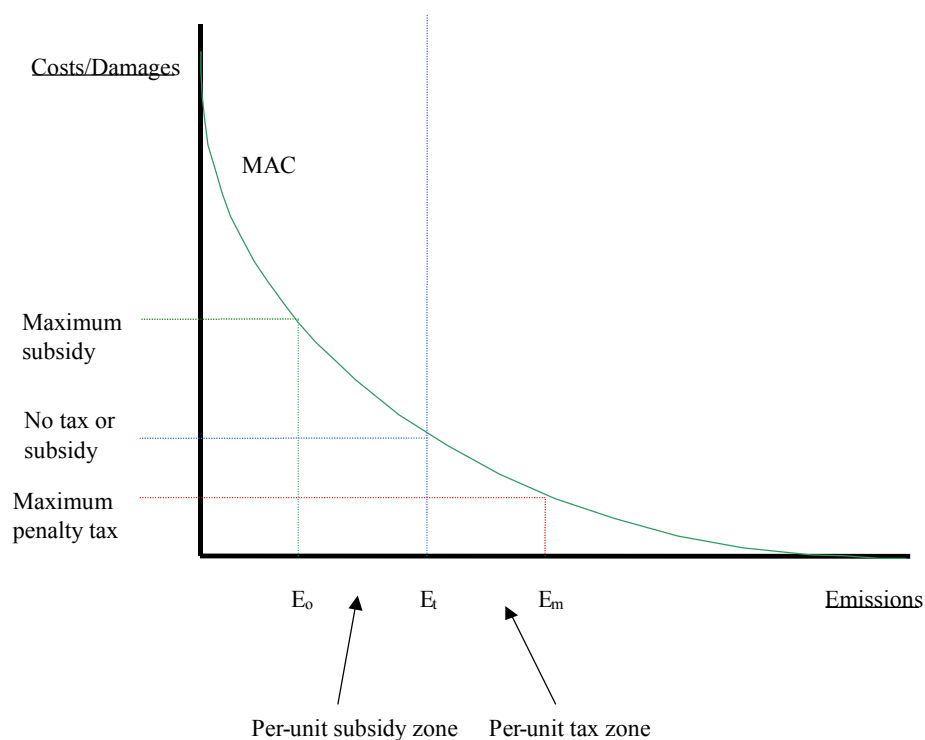


Figure 3.3 Tax subsidy scheme

The key issue here is that with a range of allowable pollution and the economic incentives, most firms would respond by abating to E_t while some would opt for the subsidy and abate to E_0 , thereby reducing the overall ambient level of pollutants.¹⁰⁵ Let us look now at specifically how this scheme might improve upon the limitations of the standard tax scheme.

3.1.5 Advantages of tax subsidy over standard tax scheme

The first limitation, as stated above, is that in most cases regulators do not know the MAC function and that an estimate of the true function must be made. In general, this could be done by aggregating what is perceived to be the most upper and lower MAC functions. Thus we could plot three functions, MAC_l (lower), MAC_a (aggregate), and MAC_u (upper), keeping in mind though that the true function lies somewhere between MAC_l and MAC_u . Looking back to the tax-subsidy scheme if we then set E_0 to where the MDF intersects with MAC_l , E_t to where it intersects with MAC_a , and E_m to where it intersects with MAC_u we can create the range of allowable pollution levels (Figure 3.4). As I have theorized, firms will in most cases move to emit at E_t while others will move to E_0 bringing the overall level of pollution down to somewhere between those two coordinates. Thus, as long as the true MAC function is between MAC_l and MAC_u , even though

¹⁰⁵ Note that the regulating authority would only pay to abate until E_0 not beyond and conversely polluting above E_m would be illegal.

it is not known exactly where, the regulating body will succeed in reducing emissions in an efficient manner without risking that any tax is too high or too low.¹⁰⁶

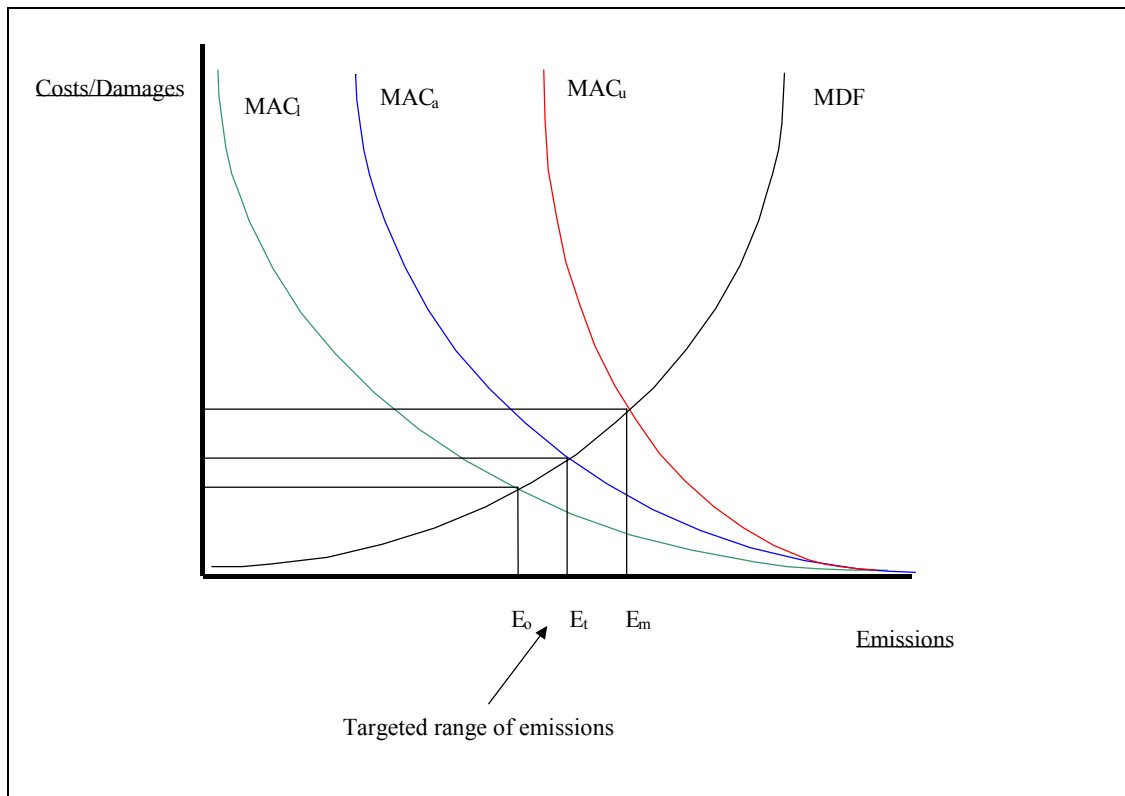


Figure 3.4 Setting a pollution range when the true *MAC* is unknown under a tax-subsidy scheme.

Addressing the second limitation of the standard tax scheme, that some firms might exercise cost-effective behaviour versus maximization and will continue to pollute above E_t , can be dealt with as follows under the tax-subsidy scenario. Even if firms are looking to save money, the possibility of gaining money is a more powerful incentive (or at least not paying a tax as would happen if they emitted at E_t). Now, while I do not have research and literature to fully support this hypothesis, it can be said psychologically that individuals and perhaps firms respond to the possibility of a reward and will modify their behaviour accordingly. Moreover, even if there are firms that opt not to take the subsidy because, as stated in the footnote 1, they do not wish to sacrifice the quality of their product, some firms will and the overall level of pollution will be reduced.

The solution to the last two limitations revolve around how to entice firms to move from E_t to E_o . In both cases either the firm cannot afford to do so or does not wish to. Thus again the idea of financial gain is paramount to altering the firm's behavior. If a firm is emitting at E_t and paying no tax but is offered a subsidy to invest in newer technologies that are marginally more expensive and will reduce its emissions to a more ecologically

¹⁰⁶ There is of course the possibility that regulators could be subsidizing a higher level of pollution than necessary if in fact the intersect of the *MDF* and true *MAC* function was higher than where they set E_t . Nevertheless, firms would still reduce their emission levels and any overpayment would be covered by the tax paid by firms that chose not to abate to E_t .

and socially sound level, with the right amount of persuasion from the regulating authority, the firm would probably accept, invest and abate.

3.1.6 Conclusion

In this short essay I have attempted to introduce and theoretically explain an alternative MBI to the simple pollution tax scheme. That with the use of a tax-subsidy scheme which creates an allowable range of pollution, the limitations associated with the simple tax scheme, namely the assumptions that marginal abatement costs are transparent; that firms always act in a rational manner to maximize profits; that the economically optimal level of pollution emission is socially/scientifically optimal; that paying a pollution tax will become a 'business cost' leaving little incentive for improved pollution control, could be overcome. Offering firms the opportunity and the flexibility to choose how much they wish to pollute based upon both positive and negative financial incentives can relieve regulating authorities from having to derive true marginal abatement costs and give them a better opportunity to entice firms to invest in 'greener' technologies. The end result will be a higher level of pollution abatement.

3.1.7 References

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3.2 The influence of equity on efficiency of emission trading under the Kyoto Protocol

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3.2.1 Introduction

Global climate change is probably the most complex environmental problem the international community faces today. Rising levels of green house gasses (GHG) through the burning of fossil fuels and land use changes are expected to change the global climate. The effects of climate change are potentially very disruptive to many communities throughout the world. The effects include, among others, desertification, flood risks, threats to biodiversity and increasing occurrence of extreme weather events like droughts and typhoons. Dealing with climate change through the reduction of GHG emissions will require comprehensive international cooperation.

There have been a number of major international conventions under the auspices of the United Nations aimed at getting the international community to take action on the issue of climate change. Two important agreements resulting from these efforts are the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto protocol. The UNFCCC that resulted from the United Nations Conference on Environment and Development in Rio de Janeiro aims at preventing dangerous anthropogenic interference with the climate. The UNFCCC was followed in 1997, by the Kyoto Protocol that recently came into effect after ratification of the Protocol by Russia. The Kyoto protocol builds on the framework provided by the UNFCCC by specifying emission targets, time-tables and mechanisms.

The Kyoto protocol recognizes the importance of market-based instruments as a way of reducing the costs that climate change policies are expected to ensue. In practice, environmental policies have concentrated mainly on command-and-control (CAC) regulations, but market based instruments have received increasing attention due to their dynamic efficiency, the expectation of less bureaucracy in comparison to CAC regulations and the incentives for environmental innovation (Carraro, 2003). One of the main market based instruments that is set up by the protocol is the system of emission trading. Emission trading will, theoretically at least, provide an efficient way of allocating emission rights between participating actors. The theoretical basis for this assertion is the Coase theorem which states that such a system, under assumption of zero transactions costs and information symmetry, will lead to an efficient outcome regardless of the distribution of emission rights.

Besides efficiency, equity plays an important role in deciding the appropriate way of addressing the climate change problem. For now, equity can in this context be described as the 'fair' distribution of the burden of climate change policies among countries. Equity will be further discussed below. Countries that do not perceive an agreement as being equitable are unlikely to participate in it. Climate change raises all kinds of equity related questions. To what extent have countries contributed to the problem, who has benefited from the polluting activities and should the effort in addressing the problem be related to these benefits? Who will benefit from these mitigation efforts and is that grounds for dis-

tributing the cost of GHG mitigation? More generally, it raises the question of how the mitigation costs should be distributed.

This paper aims to identify how equity considerations in the Kyoto protocol impact the efficiency of the emission trading scheme. What are the effects of equity considerations on the working of emission trading? Is equity actually served by the set up of the Protocol or is it counterproductive? I will deal with these questions by first discussing the concept of equity.

The significance of equity in international climate change agreements is dealt with as well as different theories of equity criteria related to emission trading. Subsequently equity in the UNFCCC and Kyoto protocol is addressed. I will identify two equity driven aspects of the protocol that affect the emission trading instrument and relate them to the equity criteria discussed earlier. Finally, the impact of these aspects on the efficiency of the emission trading mechanism is addressed.

3.2.2 Equity

An international climate change agreement will depend on voluntary compliance. There are potentially huge costs associated with climate policies and economically sound instruments can lower the threshold for participation. The participation rate of countries in an agreement can therefore benefit from employing instruments that will reduce costs. Emission trading is such an instrument since it is efficient in the sense that it maximizes overall social welfare. Although overall social welfare is maximized, the costs and benefits of climate policy are likely to be very different between countries and may consequently be seen as unfair or inequitable. For example, developing countries may regard the climate change problem as being caused by the developed world. Sharing the burden of reducing GHG emissions might not seem equitable to them, as they did not reap the benefits of the activities causing climate change. On the other hand, some developed countries argue they should not be the only ones incurring the costs, as emissions by developing countries are projected to surpass theirs. It will not be sufficient to strive for an efficient solution that maximizes overall welfare and does not take equity into account. If an agreement can be made so that it is perceived as equitably addressing such controversies it can increase cooperation between countries (Rose et al., 1998).

Since the focus of this paper is on emission trading the question now is what equity¹⁰⁷ means in the context of an international environmental agreement and emission trading in particular. From the discussion equity seems to consist of a notion of fairness or burden sharing, but what exactly does this concept of equity entail when applied? Finding a definition for equity is no easy task seeing that the climate change problem is characterized by a large number of complicated issues. These features include the global scale and irreversibility of the problem, incentives for free riding, a long time horizon of the problem, strong policy interactions, and a large degree of uncertainty on various aspects of the problem (e.g. timing and extent of impacts, required reductions). The combination of these characteristics complicates the search for a broadly accepted definition of equity, as such a definition will play out differently for each country thus making one definition

¹⁰⁷ Equity is here considered to be international equity. Intergenerational equity is not discussed.

of equity more suited to their self-interest than others. Any attempt to reach a definition of equity will therefore inevitably be liable to a high degree of subjectivity. Nonetheless, several attempts to define equity have been made despite these complexities.

Equity principles are derived from more general concepts of justice. Such theories of justice include utilitarianism, the theory of John Rawls, and the libertarian theory. The goal of utilitarianism is to distribute (material and non-material) goods in order to maximize overall social welfare. This theory will have distributional effects if benefits derived from a good for a particular person are greater than for the 'original' person benefiting from the good. On the other hand, John Rawls states that 'utilitarianism has no respect for individuals' (Rose and Kverndokk, 1999) and emphasizes the need for a theory of justice that focuses on individuals and not on overall social welfare; that the welfare of the worst-off should be maximized. The libertarian theory stresses individual freedom as the priority unless others will be harmed.

For each theory there are several different equity principles. Without pretending to be exhaustive, I will discuss some of them here. In the typology by Ringius et al. (1998) five equity principles are distinguished:

- Egalitarian, every individual has an equal right to pollute or to be protected from pollution;
- Sovereignty, current emissions constitute a status quo right now;
- Horizontal, countries with similar economic circumstances have similar emission rights and burden sharing responsibilities;
- Vertical, the economic burden increases with the ability to pay;
- Polluter pays, the economic burden is proportional to emissions.

The norms of distributive fairness used in international negotiations are seen by Ringius et al. (1999) as a 'complex framework, combining at least three different notions equality, equity and exemption.' The three notions are part of a continuous scale, along which the variances on a dimension that is considered relevant increases. Two dimensions are distinguished, namely the object to be distributed (cost or benefits) and the focal point (the cause or the consequences). The two dimensions then lead to what Ringius (1999) refers to as the four key principles:

- Guilt, distribute costs in proportion to a party's share of responsibility for causing the problem;
- Capacity, distribute costs in proportion to ability to pay;
- Contribution, a country's share of a certain good should be proportional to its contribution to producing that good.
- Need, all individuals have equal rights to pollution permits, with a minimum to ensure basic human rights.

Table 3.1 shows the two dimensions and the key principles. If the variances between parties on these key principles increase, the attention will shift from equality or equal obligations to a situation where more consideration is given to an equitable apportioning of obligations and to, finally, a situation where some parties may be exempted from any obligations.

Table 3.1

Focus on	Object to be distributed	
	Costs (obligations)	Benefits (goods)
	Cause of state of problem	‘Guilt’, responsibility
	Consequences for actors	Capacity
		Need

Source: Ringius et al. (1998), Berk and Elzen (2001)

Another prominent theory is the one proposed by Rose et al. (1998). The different kinds of equity criteria are distinguished into three classes depending on whether they apply to the initial allocation of permits, to the outcome of policy implementation, or to the process by which the criterion is chosen (Bosello et al., 2001; Rose and Kverndokk, 1999). The first class, the allocation-based criteria, focuses on distribution of emission reductions or costs. The criteria in this class are based on an inherent right of countries like the right to pollute. The second class of outcome based criteria, are applied in relation to the outcome of an agreement. These outcome-based criteria relate to the welfare effects of emission reductions. The final class comprises of the process-based criteria which relate to the process by which the criterion is chosen. Some of the justice theories are reflected in these criteria, e.g. the maximin criterion in the final category reflects the Rawls theory (Kemfert 2001). Table 3.2 summarizes the categories and the various criteria.

Several countries have suggested a variety of ways of burden sharing in the run-up to the Kyoto conference, reaffirming the subjective nature of equity. Ringius et al (1999) provides an overview of the different proposals. Having indicated the significance of equity in international environment agreements and having identified several equity criteria, I will focus now on equity within the UNFCCC and the Kyoto protocol and on those aspects of the protocol that relate to emission trading and are influenced by equity considerations.

Table 3.2

Criterion	Definition	Burden-sharing rule
Allocation-based		
Sovereignty	All nations have an equal right to pollute and to be protected from pollution.	Equalize emission reductions or costs in proportion to emissions (abatement cost as proportion of GDP)
Egalitarian	All people have an equal right to pollute or to be protected from pollution	Equal emission reductions or abatement costs per capita
Ability to pay	Mitigation costs should vary directly with national economic well-being	Equal emission reductions or abatement costs per capita in proportion to GDP
Outcome-based		
Horizontal	All nations should be treated equally	Equalize welfare costs in proportion to GDP or per capita
Vertical	Welfare changes should vary inversely with national economic well-being	Reduce emissions such that net abatement costs grow with GDP
Compensation (Pareto criterion)	No nation should be made worse off	Distribute abatement cost so that no nation suffers a net welfare loss
Process-based		
Maximin	Welfare of the worst-off nation should be maximized	Distribute largest proportion of net welfare change to poorest nations
Market justice	The market is fair	Distribute emissions reductions to the highest bidder
Consensus	The international negotiation process is fair	Distribute abatement costs (power weighted) so the majority of countries are satisfied
Sovereign bargaining	Principles of fairness are endogenous results of multistage negotiations	Distribute abatement cost according to equity principle that result from international bargaining and negotiation over time

Source: Rose and Kverndokk (1999), Bosello et al (2001).

3.2.3 Equity in the UNFCCC and Kyoto

Equity considerations have played a significant part in several international environmental agreements. Equity between nations is clearly referred to in the UNFCCC and the Kyoto protocol. The preamble of the UNFCCC states that ‘acknowledging that the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions’. Equity considerations are apparent here in the phrase ‘common but differentiated responsibilities’ indicating that there are grounds for the obligations of nations to differ.

These differentiated responsibilities are clear from the distinction made in the UNFCCC between Annex I (developed countries) and non-Annex I Parties (developing countries), as the Annex I Parties need take on additional responsibilities (UNFCCC, 1997). Fur-

thermore, article 4.7 of the UNFCCC makes the implementation of mitigation measures dependent on the extent to which the developed countries fulfill 'their commitments under the Convention related to financial resources and transfer of technology'. The same article then goes on by recognizing the priority of economic and social development and poverty eradication for developing countries over the implementation of climate change policies.

The Kyoto protocol that followed the UNFCCC set targets and timetables for reduction of GHG emissions. It allows countries to take measures collectively to achieve these targets. The protocol introduces emission trading, joint implementation and the clean development mechanism as ways for reducing emissions. The protocol emphasizes the role of equity, by reconfirming the common but differentiated responsibilities of the Parties to the protocol. As in the UNFCCC, a distinction is made between the commitments made by developing countries and developed countries.

Two aspects of the Protocol are clearly related to equity considerations. Firstly, Article 3 of the protocol states that the Annex I Parties of the UNFCCC commit to ensuring that their emission levels will not exceed those specified in Annex B of the protocol. Developed countries should take on the commitment to reduce their emissions of six greenhouse gases (GHG) by 5.2% below 1990 levels, with the European Union (EU), the United States and Japan required to reduce their emissions of such gases by 8%, 7% and 6% respectively (UNFCCC, 1997). The non-Annex I Parties are not committed to any reductions however. The difference in responsibilities between developed and developing countries is evident from this distinction.

Secondly, the Protocol states that countries taking part in emission trading shall not resort to buying emission permits only to achieve their targets, but will also undertake efforts to reduce emissions domestically. In essence this means an introduction to some extent of the polluter pays principle. Countries that have committed to emission ceilings will have to invest in domestic abatement measures.

How do these two aspects of the Kyoto protocol relate to the criteria mentioned in the previous section? Some of the equity criteria discussed earlier in this paper would be partially satisfied by the additional responsibilities of developed countries that result from the distinction between Annex I and non-Annex I Parties. The wealthier nations take on the burden by committing to emission ceilings thereby partially meeting the "ability to pay" criterion. The criterion is not fully satisfied as the difference between Annex I and non-Annex I countries is absolute, which in the light of this criterion would mean zero ability to pay and that is obviously not the case. A similar reasoning applies to the horizontal and vertical outcome-based criteria. The process-based maximin criterion is met to some extent as the burden lies with the wealthier nations while the benefits accrue to all countries. Since developing countries in general are expected to experience greater impacts from climate change, their benefits from reduction would be higher as well. The discussion can then be whether the Kyoto targets are sufficient to achieve these benefits? Of the process-based criteria, the market justice criterion is met within the Annex I group if we can assume that the emission market is competitive. Since there is no

market outside the Annex I group the criterion cannot be applied to non-Annex I countries¹⁰⁸.

When using the theory by Ringius (1998) the horizontal principle seems to be satisfied to some extent as countries in relatively similar economic circumstances take on more or less similar commitments. The developing countries have not committed to emission ceilings, whereas the developed ones did commit themselves. When judging this by the countries that signed instead of the ones that ratified the Protocol, the results are of course positively biased due to the withdrawal of the USA and Australia. The vertical and polluter pays principle are more fit to be used when looking at the relation between Annex I and non-Annex I countries. Of the four key principles by Ringius (1999), three seem to have played a significant role: guilt, capacity and need.

In the next section the two aspects that were identified as having resulted from equity considerations in the Kyoto protocol will be dealt with further to determine how they influence the efficiency of emission trading.

3.2.4 Equity and the efficiency of emission trading

The UNFCCC distinguishes between developed countries, the so-called Annex I countries, and developing countries, the non-Annex I countries. The UNFCCC recognizes that the priorities of developing countries are economic and social development and dealing with poverty. The Kyoto protocol builds on this distinction by assigning emission ceilings to the Annex I countries, while the developing countries are exempt from such emission limits. This means that fewer countries will be involved in reducing emissions and in emission trading. What consequences does this distinction, born from equity considerations, have on the instrument of emission trading?

Assigning emission permits to developing countries and allowing global trade, as opposed to emission ceilings and trading among Annex I countries only, can reduce compliance costs (Zhang, 2001; Tol, 2001). This would create an opportunity for developed countries to generate efficiency gains by profiting from relatively low-cost abatement options in developing countries. Developing countries will even benefit from such a scenario. By assigning emission rights to developing countries based on their projected emission levels, they would not be required to implement abatement measures. They could however, gain from this situation by trading permits, and reduced national emission levels would thus yield a net benefit.

McKibbin and Wilcoxon (2002) identify 'the enormous stress on the world trade system' imposed by the Kyoto protocol. Although their discussion relates to emission trading under the Clean Development Mechanism, it will hold for the above mentioned situation of global assignment of emission rights as well. They argue that there will be negative consequences on the balance of trade of a developed country due to the importing of emission permits and possibly an increased exchange rate volatility. Due to the export of permits developing countries will face an appreciation of their currency possibly leading to the break down of the export sectors. Whether the gains for developing countries from

¹⁰⁸ Non-Annex I countries can take part in emission trading as part of the Clean Development Mechanism, but this is not part of the scope of this paper.

the emission trading will outweigh the losses caused by their appreciated currency is unclear. One can conclude though that it is likely that the benefits of emission trading will be reduced by effects on international trade. There may furthermore be possibly significant effects for groups within developing countries dependent on export industries.

A consequence of the higher cost level resulting from the different obligations for Annex I and non-Annex I countries is that it reduces the incentives for countries to sign and ratify the Protocol. The decision of a country on whether or not to join an international climate change agreement depends on the way the burden of the mitigation efforts is shared (Carraro, 2000). Without the burden being shared equitably, countries may not find it profitable to sign an agreement. Carraro (2000) identifies two factors that determine the profitability: the size of the coalition and the distribution of costs within the coalition. These two factors are interdependent. An increase in the size of the coalition will reduce abatement costs in the countries that join the agreement. This cost reduction then creates incentives for other countries to sign the agreement, which will further increase the coalition size and reduce costs.

As shown, the cost levels for countries committed to emission ceilings are higher than they would be under global participation in emission trading. The United States withdrew from the protocol because of, amongst other reasons, the costs associated with meeting the emission reduction targets. They argue that its implementation will lead to greatly reduced growth and possible recession (EPA, 2001). Reducing costs, compared to taking domestic action only, is possible through emission trading. Shogren (1999) states that 'it is estimated that any agreement without the cost flexibility of trading will at least double the USA costs'. The U.S. fears that potential permits selling countries may not meet the conditions (e.g. monitoring requirements) for emission trading. Other arguments for the U.S. position relate to the lack of emission ceilings for developing countries. In its analysis of the protocol the U.S. states that the U.S. reduction will be half of the increase in emissions of developing countries. Emission levels of developing countries, according to the U.S. analysis, are already higher than those of the developed world.

Although it is not possible to conclude that the U.S. would have ratified the Kyoto protocol if developing countries would have been included, the absence of non-Annex I countries as participants in emission trading did however contribute to the USA's rejection of the Protocol. Following the previous reasoning the U.S. rejection (and in fact every country that does not join) creates a disincentive for other countries to join the Protocol by limiting the size of the coalition.

The limited number of participating countries raises another obstacle to the broadening of the coalition through the existence of so called hot-air. Due to the economic decline in Russia and Ukraine current emission levels are below the 1990 target levels of the Kyoto protocol. The difference between emission permits between current emission levels and the Kyoto target levels constitutes a financial transfer from permit buying countries to Russia and Ukraine. Zhang (2001) shows that Russia and Ukraine can expect the highest gains from trading within Annex-I countries only. If trading were to be global these gains would drop by over 80%. Permit buying countries would benefit from the increased supply of permits and from the lower abatement cost options. Russia and

Ukraine therefore do not have an incentive to increase the efficiency of the emission trading mechanism by stimulating entry of other countries.

The existence of large quantities of hot-air in a limited number of countries can have negative repercussions on efficiency when these countries are able to display monopolistic behaviour. Russia and the Ukraine can influence the price of permits in order to maximize their profits from their excess supply of permits. Monopolistic behaviour requires a limited number of suppliers on the international permit market and supply would therefore have to be centralized and not be done through individual firms (Baron, 1999). Parties to the Kyoto protocol are required to have in place a national registry of permits when participating in permit trading. Transfers and acquisitions between national registries are made under the responsibility of the Parties and transfers or acquisition of permits are to be supervised by the Party to ensure “that it acts in accordance with the rules and remains responsible for the fulfillment of its obligations” (UNFCCC, 2001). International trade of permits will thus be done through national registries so that trade will indeed be centralized thereby creating opportunities for monopolistic behaviour (Klepper et al., 1999) leading to increased costs for permit buying countries.

Nations can exchange emission rights under the Kyoto protocol, but the Protocol limits this trade at the same time. Article 17 states that emission trading should be ‘supplemental only to domestic actions for the purpose of meeting quantified emissions limitation and reduction commitments [...]’. There is no quantification of the extent to which countries can supplement their domestic actions with emission trading. Nonetheless, it poses a restriction on the emission trading mechanism and one can question how this affects the efficiency of the trading mechanism. Let us look first at the rationale behind this restriction.

The restriction was introduced for equity reasons so that developed countries will be compelled to take mitigation measures in order to reduce their own emissions instead of relying on the purchase of emission rights from less developed countries. These would be obtainable at relatively low costs, given the lower abatement costs in these countries. Efficiency reasons are also argued for introducing restrictions on emissions trading (Carraro, 2003). The higher mitigation costs, compared to completely free trade, would create incentives for environmental innovation and implementation of environmental friendly technologies that would offset higher permit prices. This argument is counter-intuitive to what one would expect in economic theory. Theoretically, the free trade of permits would lead to the social welfare optimum, where any restrictions on trade reduces social welfare and would therefore prevent an efficient allocation of resources.

Buonanno (2003) shows that increased innovation induced by trade restrictions does not generate enough benefits in terms of reduced abatement costs or higher economic growth to justify such restrictions. A policy without restricted trading yields higher economic growth. Research and development expenditures decrease under a broader coalition of countries included in emission trading and will increase when restrictions are placed on the amounts of permits to be traded. Changes in innovation differ though between various world regions and countries under trade restrictions. On the one hand, expenditures on innovation will increase in countries that are net buyers of emission rights since emission rights will be higher thereby creating a greater incentive for these countries to innovate. Net sellers on the other hand, will reduce their innovation efforts as any surplus of

rights they may generate from this innovation cannot be sold. The study by Buonanno (2003) even finds that equity is not positively affected by establishing trade restrictions. Both in the short and long term, developing countries are better off without limits on the emission trade, although the study does not give any indications why this is the case.

The conclusion can be drawn that trade restrictions have a negative impact on the efficiency of the emission trading scheme. Moreover, research suggests that they fail to meet the targets they seem to be intended for, namely increasing equity and increasing benefits through higher economic growth. The restrictions in the Kyoto protocol are not specified so far, but proposals have been made by the EU to do just that. This does not seem the right direction to take.

3.2.5 Conclusion

Equity is very significant to environmental agreements. Given the huge cost associated with the implementation of environmental policies it is important to try to find efficient ways of emission reductions to reduce the overall burden. Efficiency alone is not enough however, as climate change policy can have large distributional effects and an agreement will need to be perceived as equitable for countries to participate. It has proven difficult to find a definition of equity that is broadly accepted due to the complexity of the climate change problem and the potential benefits and costs of accepting such a definition by the various countries. Three classes of equity criteria were identified: allocation-based criteria, outcome-based criteria and process based criteria.

Equity is present in the UNFCCC and the Kyoto protocol through the principle of common but differentiated responsibilities. This has influenced emission trading in two ways. On the one hand, there is the distinction between countries with and without emission ceilings, where the first take part in emission trading and the latter do not. On the other hand, a restriction on emission trade exists due to the obligation to take domestic action. I have then related these to the equity criteria.

The effects of the distinction between Annex I and non-Annex I countries were discussed. This distinction tends to increase the compliance cost as low cost abatement options in developing countries cannot be used. Global assignment of emission rights can be a good alternative although impact on the trade balance and national currencies may cause negative effects. The limited number of participating countries will lead to reduced incentives for countries to join the Protocol as costs will be higher than under a broader coalition. Furthermore, it leads to a significant increase in the benefits for Russia and the Ukraine that thereby have an incentive to discourage the joining of non-Annex I countries. The way the emission trading is designed leaves opportunities for monopolistic behavior by countries, especially for large sellers like the aforementioned countries. The requirement that emission trading should be supplemental to domestic action does not have much backing by economic research. Restrictions on trade do not result in higher economic growth and there seems to be no evidence that it increases equity.

It has become evident that equity and efficiency cannot be separated. Without serious consideration of equity aspects countries may withhold their support for an international climate change treaty. Reduction of the number of participants has significant negative impacts on the efficiency of an emission trading scheme that can further reduce incen-

tives for countries to join such an agreement. The equity aspects of the Kyoto protocol are often at odds with efficiency. It is unlikely that the two can always be reconciled, so a trade-off may be required between efficiency and equity considerations in order to find a balance that is the most beneficial to goals of an international climate change treaty.

The influences of equity considerations on emission trading under the Kyoto protocol often have results that do not increase equity. Efforts to reach an international agreement that succeeds the Kyoto protocol may benefit from an increased understanding of the consequences of equity considerations. Benefits exist for both developed and developing countries in terms of costs and larger emission reductions. Despite the sometimes counterproductive efforts to take equity into the consideration, the fact that the distinction between the obligations of developed and developing countries is mentioned in the Kyoto protocol and UNFCCC and put into practice through the different commitments can in itself be seen as an important milestone. It is at the least an important recognition of equity as a vital aspect in climate change policy and a start to finding more effective ways of addressing it.

3.2.6 References

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3.3 Privatisation of Drinking Water Supply: A Case Study: Sofia, Bulgaria

Author Matteo Roggero

Legend

EU	European Union
CEE	Central and Eastern Europe
SV	Sofiska Voda
MoS	Municipality of Sofia
WFD	(European) Water Framework Directive
EBRD	European Bank for Reconstruction and Development
UNDP	United Nations Development Programme
DMC	Department for Monitoring the Concession
O&M	Operating and Maintenance (costs)
Ofwat	Office of water services (UK water monitoring body)

3.3.1 Introduction

The context

This case study is centred on the privatisation of drinking water supply that took place in 2000 in the municipality of Sofia, Bulgaria.

This practice is not new and is part of a large restructuring process happening everywhere in Europe: the management of municipal utilities – water management included –

is passing from public to private hands, thus raising fundamental questions about how to appropriately deal with the most fundamental good in human life, water.

Sofia's water, particularly drinking water, is now in private hands: a private company – Sofiska Voda (SV) was created as a joint venture between the Municipality of Sofia (MoS) and a US/UK based trans-national company, International Waters. The outcome of the international tender assigned to the newly created company the task of rehabilitating the outdated and leakage prone water supply, sewage and waste water treatment network. The new company has committed itself to investments in the amount of \$150M, backed by a loan granted by EBRD to the winner of the tender. The ultimate beneficiaries of these investments and of the whole privatisation process will be the citizens of Sofia, hence they will be the ones who will have to bear the costs of the rehabilitation.

Paper objective

This paper tries to examine the appropriateness of the privatisation process in addressing the rehabilitation issue presented above. Will privatisation provide a better service to the citizens at lower costs? What can be said about the likelihood of the network rehabilitation process? Are the arguments in favour of a privatised water management backed by evidence or sound reasoning? If not, what can be the reason urging MoS to privatise its water supply?

In order to answer these questions, we have to focus on the aspects involved by a “private sale” of water: can water be supplied in the same manner as any other good? The content of the paper will try to answer this question.

Paper contents

A dilemma is presented between two different approaches towards drinking water supply: water as a human right and water as an economic good. Since drinking water is a scarce resource, water pricing can be used to ensure efficient water consumption. Nevertheless, the central value of water for human health and welfare makes it necessary to provide sufficient, healthy drinking water to every member of society – also to those that cannot pay the price for it. Hence, efficiency and affordability come at odds.

Obviously, the dilemma between the two approaches has policy implications concerning the management of drinking water supplies. These implications are most evident in the case for privatisation, where the economic viability of the private supplier and the social objectives of the municipal policy have diverging goals and interests.

Furthermore the European Water Framework Directive promotes the use of economic instruments in water management, putting water pricing at the very centre of the discussion.

A comparison between water management systems is outlined, reviewing practices in the EU and in the former Warsaw Pact countries. Particular attention is put on pricing regulations: how to reconcile cost covering goals of the operator with affordability aspects of the water charges?

The specific case for Sofia is then examined: what can we expect? What is actually happening? The concluding recommendations summarise the key lessons that can be drawn from the Bulgarian experience.

Table 3.3 Water management privatisation in CEE.

Concession	Company	Multinational	% owned	Year
Armenia				
Yerevan (management contract)	Acea & Company Armenian Utility S.c.a.r.l.	Acea	55	2000
Bulgaria				
Sofia	Sofijska Voda AD	International Water/United Utilities	50	2000
Croatia				
Zagreb (BOT)	Zagrebacke Otpadne Vode doo	RWE Aqua / SHW Hoikter Wassertechnik	100	2000
Czech Republic				
Prague	Prazske vodovody a kanalizace (PVK)	Vivendi/Anglian Water	66	2001
Brno	Brno VaK	Suez-Lyonnaise	31	
Ostrava	Ostravke VaK	Suez-Lyonnaise	40	
	Jihomoravske VaK	Suez-Lyonnaise	34	
Karlsbad	Vodarny Karlovy Vary	Suez-Lyonnaise	49.8	
	Severomoravske VAK	Suez-Lyonnaise	45	
	Severomoravske VAK	Anglian Water	53.4	1999
Southern Bohemia	VAKJC	Anglian Water	92.7	(1999)
North Bohemia	SCVK	Vivendi	43	1999
	Aqua Servis	Vivendi (via SCVK)	27.2	1998
	VaK Kladno-melnik	Vivendi (via SCVK)	17.7	1998
	VaK Mlada Boleslav	Vivendi (via SCVK)	22.9	1998
	SVS	Vivendi	100	1998
	Vodospol Klatovy	Vivendi	100	1999
	AQUA Příbram	Vivendi	100	1999
	VOSS Sokolov	Vivendi	100	1998
Pilsen	Vodarna Pilsen	Vivendi	98	
Olomouc		Vivendi		2000
Sumperk	Sumperska Provozni Vodohospodarska Spolecnost (SPVS)	Suez Ondeo	82	2001
Estonia				
Tallin	Tallinna Vesi	International Water/United utilities	50.4	2001
Hungary				
Kaposvar	Eaux de Kaposvar	Suez-Lyonnaise	35	
Pecs	Pecsi Vizmu	Suez-Lyonnaise	48	
Budapest	Budapest Water	Suez-Lyonnaise/RWE	25	1998
Budapest	Budapest Sewerage	Vivendi/Berlin Wasser	25	1998
Szeged	Szegedi Vizmu	Vivendi	49	1994

Concession	Company	Multinational	% owned	Year
Poland				
Gdansk	SAUR Neptun Gdansk	SAUR	51	1992
Bielsko Biala	Aqua SA	International Water/United Utilities	25	1999
Romania				
Bucharest	Apa Nova Bucuresti SA	Vivendi	100	2000
Ploiesti	Apa Nova SRL	Vivendi	80	2000
Timisoara	Aquatim	Suez-Lyonnaise	51	2000
Slovenia				
Maribor (BOT)	Aquasystems d.o.o	Suez-Lyonnaise/Steweag	100	1998

Source: PSIRU (2003).

3.3.2 The dilemma: is water a human right or an economic good?

This section introduces the main theoretical dilemma underlying the privatisation issue: should water be considered as a human right or is water an economic good? The concepts connected with both approaches are presented, together with an integrating perspective.

The Right to Water / Water as a Human Right

A General Comment¹⁰⁹ issued by the UN Committee on Economic, Social and Cultural Rights reports the following:

1. "Water is a limited natural resource and a public good fundamental for life and health"
2. "The human right to water is indispensable for leading a life in human dignity. It is a prerequisite for the realisation of the other human rights"
3. "The unequal distribution of water exacerbates poverty"
4. "The legal bases of the right to water contain entitlement of everyone to sufficient, accessible, safe, affordable water for personal and domestic uses, and necessary to prevent death and diseases"
5. "The right to water contains both freedoms and entitlements: among the freedoms is the right to maintain access to existing water supplies necessary for the right to water and the right to be free from arbitrary disconnections of water supply"
6. "Water should be treated as a social and cultural good, and not primarily as an economic good"
7. "The main requirements for the realisation of the right to water are: availability, quality, accessibility, (...) economic accessibility, non-discrimination, information accessibility concerning water issues"

¹⁰⁹ General Comment No. 15/2002, dated 26 November 2002 (E/C.12/2002/11). The General Comment (GC) is adopted in relation to art. 11 - right to an adequate standard of living and art.12 - right to health - of the International Covenant on Economic, Social and Cultural Rights (ICESCR). The text is reported by BGRF, 2003. Rather than focusing on its legal value, we simply aim to present a conceptual framework for treating (access to) water as a human right.

8. “Special attention is given to non-discrimination and the need to adopt low-cost targeted programmes for vulnerable members of society”
(Quotation from: BGRF, 2003)

Further in the text, the responsibility of the state in implementing the directions mentioned above is defined: the state is responsible for ensuring and controlling the water resource itself as well as the right to water, *“no matter by whom water supply is operated – by the state or by other actors and persons commissioned”*. The presence of third parties in water supply implies an obligation for the state to enact control legislation by establishing a monitoring body *“with genuine public participation and with the provision of penalties in cases of non-compliance”*. In other words, even if the state leaves the provision and supply of water in the hands of private parties, it remains ultimately responsible for the realisation of the right to water.

Concerning water demand, the text defines as a further responsibility of the state to ensure the efficient use of water by end-users, and the reduction of water wastage in its distribution.

The following points summarize the most relevant issues for this case study:

1. Treating water as a Human Right means guaranteeing access to water for every citizen, independently of his purchasing power, status, situation;
2. It's common interest to provide universal access to water for all citizens of a community. It is vital for the community's functioning as a whole. An uneven distribution of (the right to) water will exacerbate the poverty;
3. Disconnections from the water supply are not compatible with the right to water¹¹⁰;
4. Even under a private regime in water supply, public authorities remain responsible for the realisation of the right to water;
5. The right to water encompasses quality, quantity and affordability.

The text offers many opportunities for critical remarks: for example, referring to the quoted excerpts, it's not specified why and how the definition of “limited natural resource” does not contradict the “entitlement of everyone to sufficient, accessible, safe, affordable” use of water – which is the main issue at stake. The limited nature of water implies that there might not be enough for everybody, even if we merely talk of the access to a “sufficient” amount of water: if drinking water is scarce and limited but population grows, the amount of water available for each member of a specific community decreases and can decrease below what's meant as “sufficient”. Restrictions in the use of water can (and do) occur, clashing with the entitlement to water availability. The economic approach to water addresses exactly this question.

Water as an economic good

The approach to water as an economic good is centred on how water demand and water supply interact.

The economic theory relies on price signals in order to match supply and demand of a determined good. Prices are the outcome of market transactions and express the relative scarcity of the good. The market will move towards a situation in which the good

¹¹⁰ It has to be however specified when a disconnection is “arbitrary”.

reaches an optimal price, matching the marginal costs of the suppliers and the marginal benefit gained by the consumers. For example, a price lower than optimal will induce a higher demand than the possible supply (for that price) – this will make the price go up.

What the market mechanism implies (and requires) is a supply and a demand reacting to price signals. In the case of water supply, this assumption doesn't hold in a straightforward fashion.

On the demand side, elasticity in water consumption has been assessed nil or very close to 0¹¹¹. This means that even high increases in water prices are not likely to alter the quantity of water used by households¹¹².

On the supply side, several circumstances may bias the relationship between (marginal) costs and the price against which the service is provided, namely the situation of natural monopoly and the presence of externalities.

Natural monopoly & market failure

One requisite for the mechanism shown above to hold is that neither suppliers nor consumers (the individual actors behind demand and supply) can individually influence (or set) prices. Describing a situation such as water supply, where the latter is represented by only one actor, this assumption has to be realised.

The monopolist is price maker and is assumed to maximise his own profit, matching (own, private) marginal prices with marginal costs. This can end up in a “price setting” behaviour and in an artificially restricted supply, connected to a higher price and a consumer surplus.

In a competitive situation, the presence of positive profits (represented by the producer surplus) would attract other producers, hence increasing supply. Prices would go down and suppliers become “price takers”. The fact that this cannot happen leads to the situation of monopoly.

The figure below summarizes the situation.

¹¹¹ See Alitchkov/Kostova, 1996.

¹¹² This is particularly true for Sofia (and Bulgaria in general), where even high inflation and a high increase in water prices in a situation of drastically decreasing welfare haven't affected the demand for drinking water See Alitchkov/Kostova, 1996.

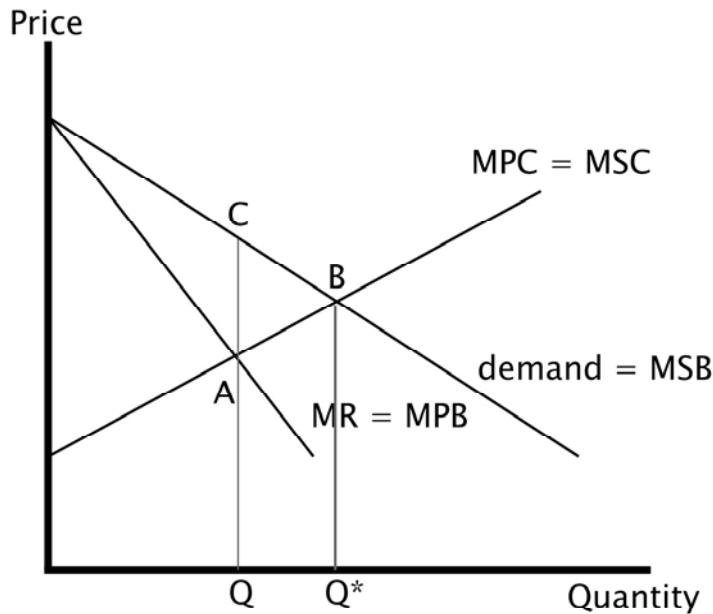


Figure 3.5 Monopoly and market failure.

MR represents the monopolist's marginal revenue and corresponds to the marginal private benefit of the supply of the good. The marginal revenue differs from the demand curve, which represents the marginal social benefit of the supply. Marginal private and social costs are, so far, equal.

In a perfect competitive environment, demand and supply would meet at B . Nevertheless, the monopolist is interested in maximising his profit, preferring quantity Q (represented by A , where $MC=MR$) to quantity Q^* (the socially optimal quantity). This leads to an artificial generation of scarcity, forcing demand and supply to meet at C , at a lower quantity and a higher price¹¹³.

Externalities and market failure

According to what is stated above, the supplier chooses the level of output considering, among other things his private costs. Economic activities dealing with environmental media seldom produce costs for the supplier only. This means that the activity of the water supplier generates costs not only for the supplier himself (which we could call "internal costs") but also implies costs for others. Here we have to introduce the concept of "externalities".

Externalities can be roughly defined as "external costs" of a market transaction. In order to qualify as externalities, these costs have to have a non-monetary nature and have an unintentional affect on a third party, not directly involved in the market transaction.

¹¹³ Please note that in order to provide quantity Q , the supplier incurs in costs as high as A but collects revenues as high as C – this shows how this situation generates a surplus (or profit) for the monopolist.

Considering water supply as a commodity, several costs have to be taken into account:

1. production costs;
2. environmental costs;
3. non-supply costs.

The production costs relate to maintenance and operating of the waterworks that make water supply possible. The environmental costs relate to ecosystem and biodiversity loss due to abstraction, construction of the waterworks and release of untreated or nutrient laden waters into the environment. Non-supply costs relate to all societal costs that can occur from the disconnection of households from the main network. Households incur welfare losses in the case of a disconnection from the water network. These private welfare losses are already included in the trade-off behind the market transaction that led to the disconnection. Though, since they concern sanitation and health, they are likely to extend to other households, causing externalities.

Of the three cost categories listed above, only the first affects the price-making capabilities of the private monopolist¹¹⁴. It is possible to show how this circumstance leads to a socially inefficient situation. For the intentions of this study, it is enough to argue that the interaction between demand and supply can be, as shown above, flawed.

A comparison

Focussing on a set of six topics, the table below offers a comparison between water as a right and as an economic good.

We see the two approaches diverging on all issues. Nonetheless, they seem to complement each other: the economic approach offers a methodology for dealing with the allocation of the good, while the human-right approach sets minimum standards that have to be met by/with this allocation. Once these minimum standards are fulfilled, nothing hinders the use of an economic approach when dealing with water issues¹¹⁵. Hence, economic instruments can promote efficiency in water supply, but regulatory bodies are needed for this efficiency to respect basic human needs.

¹¹⁴ This is (partly) not true: the state can charge the water company for water abstraction, partly recovering environmental costs if the revenue is earmarked for conservational purposes. Furthermore, the state will probably subsidise households that cannot afford water bills, thus minimising the (also external) consequences of eventual non-supply. Nevertheless our exceptions hold: water can be treated as a commodity per se, but externalities arise, highlighting a market failure and calling for state intervention.

¹¹⁵ This consideration opens a window for an instrumental approach towards privatisation. This will be discussed further.

Table 3.4 Comparison between human-rights and economic approach.

Issue/Water as...	Human Right	Economic Good
Access	Universal (disconnection not allowed)	Supply only against the payment of a due price (disconnection in case of non payment)
Quality	Enough to ensure a minimum standard of living	Based on market transaction (matching of demand and supply)
Quantity	Enough to ensure a minimum standard of living	Based on market transaction (matching of demand and supply)
Affordability	Water price must not exceed the household's contribution power	Water price has to cover costs and ensure a reasonable profit for the supplier
Price regulation	Needed in order to cover state's responsibility for the right to water	Distorsive of market mechanisms (but needed in order to correct market failure)
Scarcity	Not addressed (per se)	Addressed by market interaction (but artificially increased in case of monopoly)

3.3.3 The European context

The previous section introduced two diverging approaches towards water supply, indicating the need for a balance. This section shows how this balance is obtained in several EU and CEE countries. A section on the European Water Framework Directive (WFD) represents a frame for this review by suggesting areas of comparison. The specific relevance of the European WFD for this case study has to be stressed: the directive not only has the role of harmonising EU regulations, but also constitutes a benchmark and a policy reference for all CEE countries moving towards their EU accession in the next years. Moreover, WFD implementation aspects are even more crucial considering the high amount of investments that they imply.

Water Pricing and the European WFD

The new European Water Framework Directive (WFD) reinforces the use of economic instruments in water policies, focusing on water pricing and the principle of full cost recovery.

An appropriate water pricing system has to achieve two goals:

1. To represent an incentive for the consumer to reduce water consumption;
2. To ensure the economic viability of the supplier by means of the full recovery of the supply costs.

In this sense, the price paid by the consumer has to be related to the amount of water used and has to incorporate all costs connected with the water supply, including environmental and resource costs (respectively ecosystem loss and depletion).

On the demand side, water metering is the key issue. In cities like London or Amsterdam, households are seldom provided with water meters¹¹⁶. Water bills are calculated on a series of indicators such as the number of persons living in the household or the surface of the apartment. The price paid for water does not relate to the actual water consumption and is often incorporated in the rent as a constant amount. On the contrary, water meters are required by law in Sofia since 1995.

This implies that the costs connected with the water supply are redistributed among the user in a fashion that can be based on water usage (in Sofia) or not (London, Amsterdam). The option for one or the other tariff system can have a direct environmental outcome by reducing/avoiding wastages and promoting water conservation: since the consumer pays for the water used, he is supposed to attach a proper value to the good consumed.

On the supply side, the water pricing system has to incorporate the full cost connected with the supply of water. Revenues from water billing have to fully cover the operating and capital costs of the water company, and environmental costs have to be included in the form of a tax or by internalising these costs in the balance of the operator. Currently in Europe, revenues from water billing account on average for 75% of the total costs borne by the supplying company, implying that the rest is covered by means of subsidies. For CEE countries, figures can be as low as 25%. The principle of full cost recovery aims particularly to reduce cross-subsidisation within society and between sectors of the economy: the most striking examples in Europe are between urban and rural populations (with the urban indirectly subsidising the rural population) and between industry, households and agriculture¹¹⁷.

Concerning CEE countries, the support for the transition towards an “economic” water management has to be viewed in the light of the huge amount of (foreign) investment to which the whole country has committed itself in order to reach this goal. In this sense, the WFD’s outlook on water pricing has not two but three objectives:

1. An economic objective: to move away from loss making public service supply;
2. An environmental objective: to promote resource conservation and demand management by linking water tariffs to water consumption;
3. A financial objective: to provide financial means for the rehabilitation process through tariffs.

Tariffs have to incorporate and shift onto the customers the costs of the rehabilitation process¹¹⁸, creating a context in which foreign investments can pay back.

The European WFD offers us three economic criteria for a comparison:

¹¹⁶ Though, water metering devices will be gradually installed in city of Amsterdam. See REC, 2000.

¹¹⁷ The urban population fully pays back (via tariffs) for the costs of water supply, while the rural population pays only to a lower extent. Since water companies operate on the whole river basin, it’s the very same water company collecting revenues from both urban and rural populations in a way that doesn’t reflect the respective costs of the service. Nevertheless, for the Sofia region, this issue can be left apart, as water abstraction for drinking purposes in the capital city are the dominant goals of all regional waterworks.

¹¹⁸ See Sofia CDS, 2003.

1. Water metering;
2. Full cost recovery;
3. Financial function of tariffs.

Aiming a comparison between economic and human-rights-related approach to water, we will add one more criterion:

4. Price regulation method.

Water pricing & drinking water supply in CEE & EU

Table 3.5 Water pricing in selected EU and CEE countries.

Country	Water Metering	Cost Recovery	Financial Function of Tariffs
Hungary	97% of the population	100% O&M 15% investments	No, investment costs are covered by state subsidies
Croatia	-	50%, 100% of O&M	Yes, although large scale investments are centrally financed
Romania	Yes, compulsory	100% of O&M	Partly, between 5 and 10%
Bulgaria	90% of the population	8-47% Overall costs	No, investment so far financed by the state
Estonia	-	85% O&M & depreciation costs	-
Czech Republic	62% of the population	100% O&M & depreciation costs	Yes, but via the State Environmental Fund
England and Wales	17% of the households, 100% of non-household users.	100% of O&M (via price and revenue regulation by Ofwat)	No, finance needs are satisfied in the capital market
France	Yes	90% but with cross-subsidies in favour of agriculture	No: investments generally financed by the municipalities
The Netherlands	Partly	75%	Yes, charges cover costs for infrastructure
Italy	Yes	40-50% of O&M costs	No, state contribution finance investments

Source: REC 2000, WB 2003, meif.org 2004.

Tables 3.3 and 3.4 display the criteria mentioned above in relation to a selection of EU and CEE countries.

Table 3.6 Water pricing in selected EU and CEE countries.

Country	Price Regulation Method
Hungary	Central office sets a price cap
Croatia	Water prices and water charges set by governmental agency (Hrvatske Vode).
Romania	Prices approved by (governmental) Competition Office. Supply by National Company Romanian Waters.
Bulgaria	Price set by the Ministry of Environment and Water (MoEW).
Estonia	Water prices approved by the Ministry of Environment.
Czech Republic	Ministry of Finance is responsible for water prices. No social policy is connected with water pricing.
England and Wales	Price-Cap regulation: maximum price set by Ofwat for each company; prices are cost-reflective; binomial tariff structure; falling block for commercial users.
France	Binomial tariffs (fixed amount + volumetric charge); prices are responsibility of the mayor, monitored by French Water Agencies; prices aims at cost recovery.
The Netherlands	Prices adopted by Municipality/Province on proposal of the director of the water supply agency; no one water bill but several bills/tariffs.
Italy	Price cap set by a central committee; suppliers cannot exceed the cap above a certain measure; the cap is cost-reflective.

Sources: REC 2000, WB 2003, meif.org 2004.

Some findings can be highlighted:

- O&M costs are in general recovered;
- Investments are generally financed with taxpayers' money;
- Water metering is more diffused in the CEE than in the EU;
- Price regulators often refer to producer's costs in order to define a price level.

On the other hand, most users already pay according to their actual water consumption: that means that an incentive mechanism aimed at water conservation is already in place. Prices can be used as an instrument to reduce water usage, though with the restriction mentioned concerning human rights.

A first, the conclusion is that a raise in prices with investment recovery purposes can have a parallel environmental benefit connected with a decrease in water abstraction and eventually a social benefit connected with decreased water shortages. However, the costs of this policy are social in nature and can be high.

The next section, presents the situation in Sofia, and will specifically analyse the above issue in the context of the water management privatisation process in the capital of Bulgaria.

3.3.4 The privatisation of drinking water supply in Sofia

Sofia is home to 1.2 million inhabitants. Similar to many other cities in eastern Europe, Sofia has experienced a hard recession period following the collapse of the communist regime. Sofia's population has been declining over the last decade. Unemployment is a major concern, although it is lower than in the rest of Bulgaria, and increasing inequalities in income distribution can be observed.

Furthermore, a high percentage of Sofia's population lives in poverty: the World Bank estimates that some 410.000 can be considered poor, earning less than 2/3 of the average income for the country as a whole¹¹⁹. This situation makes affordability issues particularly relevant for any rehabilitation policy.

Concerning the water basin, some general information could be retrieved via the website of MoS.

"The water supply of Sofia is conducted through three main water sources:

1. Controlled waters in the Beli Iskar reservoir and river catchments of the Iskar river and its tributaries – 9 in number. The average capacity is 1,500 litres/sec;
2. Controlled waters from the Iskar reservoir – 6,500 litres/sec;
3. River catchments, coming from Vitosha Mountain – 5 in number. The average annual capacity varies from 130 to 300 litre/sec"

(Source: <http://www.sofia.bg>)

The Iskar reservoir (originally Stalin Dam) is Bulgaria's largest water work. It was originally built in 1956, for hydroelectricity purposes, industrial water supply and, irrigation; while Sofia's potable water needs were met from local mineral water springs and upper water storages from Vitosha Mountain. The share of water from the Iskar Dam used for drinking purposes grew constantly until present, in order to satisfy Sofia's almost triplificate population. Further (interbasin) river diversions had to be effected and additional water sources were sought in the Rila Mountains.

The main reason for this large water infrastructure can be sought in the drought prone nature of Bulgaria's climate. However, due to their bad condition, these infrastructures couldn't avoid a major water shortage in 1993-1994. Journalistic sources report that the level of the Iskar dam reached a minimum of 50 mln. m³; water had to be rationed with 18hrs on – 56 hrs off basis for half of the population.

After the water crisis of 1993-1994, the intention of the authorities has moved away from stimulating further abstractions/diversions towards a network rehabilitation process. Presently, water losses account for almost half of the total drinking water distributed throughout the network.

After the failure of some previous attempts¹²⁰, the transition to a private regime under SV is thought to continue and complete this task, reducing water leakages to EU standards¹²¹.

In 1999, an international tender awarded to International Waters the managers of Sofia's water system. The winner of the 25-year concession has committed itself to a rehabilitation investment programme of \$150M, to be realised in the first nine years of activity.

¹¹⁹ Source: Sofia CDS, 2003; pg. 25. The document refers to WB, 1999: *"Bulgaria – Poverty during the transition"*.

¹²⁰ Prior to the concession to SV, MoS had already undertaken a massive rehabilitation programme of the distribution network, in order to reduce water losses. This happened in cooperation with the French company Saur International. Consultations were held in 1992, aimed at the constitution of SV, but the parties failed to reach an agreement. The poor condition of the infrastructure network was already known at that time.

¹²¹ The present goal is to reduce losses to 25%.

A monitoring body, the Department for Monitoring the Concession was established with the purpose of monitoring the advancement of the investment programme and ensuring a socially acceptable water price¹²². SV is obliged to cooperate with the DMC, but the DMC has no binding power over SV.

What we might expect

4. We have shown that a supplier, in a monopoly situation, has the possibility to maximise his own profit reducing supply and increasing prices. Prices are expected to go up.
5. The concession has a binding nature. It means that the concessionaire has committed itself to a large investment. However, if the concession is not effectively enforced, the monopolist has an incentive to put the needed rehabilitation into practice only to the extent to which this will pay off. Revenues have to establish a certain cash flow in order to cover the investments and secure profitability. If affordability constraints weaken and put uncertainty upon these revenues, no investments will be made, services will not improve and the network will further decay.
6. The environmental performance of the privatisation process is likely to be poor. The main environmental concern is connected with water losses; these are not likely to be reduced for two reasons:
 - Water losses depend highly on the rehabilitation of the network. They will continue until the due amount of investments is realised.
 - A price-induced reduction in the users' water consumption has no effect on the water leakages.
7. The concession has started a restructuring process in the water sector. Employment is not a goal for the concessionaire, which is in the position of raising prices while offering a lower level of supply and can therefore save costs laying off employees. A loss of jobs can be expected, as well as a missing improvement in the service provided.
8. Social problems might arise. We have pointed out the limited elasticity of water demand. Faced with a steep increase in water prices, households have few possibilities, particularly when their expenditure budget is extremely tight. This can exacerbate the poor living conditions of the lower (and lowest) income brackets¹²³.

What we see

Specific information (in English) about the effectiveness of the privatisation process in Sofia is surprisingly scarce. Even the evaluation of the EBRD project itself is overdue, meaning that no figures are available about any reduction in water losses and about the amount of investments actually realised. Information concerning the trend in prices and the pricing methods used by SV is also not known. Information about the measured price

¹²² The DMC is a sort of interface between SV and MoS, representing the interest of the latter's policy priorities. Moreover, MoS is a 25% shareholder of SV, maintaining the ownership of the network.

¹²³ According to our calculations, the poorest income brackets of Sofia (more than 400.000 people, 26% of the population, 19% of the households) could have water bills as high as 10% of their income.

elasticity and the reaction of the water network would prove particularly interesting for this study.

Nonetheless, a CEE-wide study¹²⁴ funded by the European Commission examines the arguments brought up in the official and public debate *against* and *in favour* of private water management, *before* and *after* the concession took place.

Before granting the concession, the arguments in favour of a private water management in Sofia focused on the criticism about the previous public governance. This has been responsible for the poor present state of the water sector, whose bad practices were due to:

- No competition;
- Absence of monitoring.

The private management is believed to perform better investment planning, to improve effectiveness, and to establish a competitive environment. This will produce:

- higher standards of service,
- customers/users protection,
- socially acceptable water prices.

The arguments “against” to the long and uncertain character of the procedure and to the possible impact of the investments on water prices. Moreover, concerns about the loss of state control over priorities such as guided investment and water price were also expressed.

After the concession started functioning, however, different concerns arose:

1. Economic concerns:
 - the investments are not made;
 - the national capital is exported;
 - foreign instead of national producers and experts are employed by the foreign actors.
2. Social concerns:
 - prices of water increase constantly and unreasonably;
 - the employees are made redundant;
 - the quality of service is not improved;
 - national subcontractors and experts are excluded.
3. Environmental concerns:
 - water losses do not diminish,
 - the installations are not properly maintained and renovated.

What these concerns suggest about the situation in Sofia’s drinking water supply is that prices have gone up, services have not improved, installations are still decaying, water losses have not decreased, jobs are lost, and inequality has been exacerbated. Six out of nine circumstances were expected and have been anticipated in the previous section¹²⁵.

Discussion

We have now all elements to answer the questions.

¹²⁴ See Penevska, 2004.

¹²⁵ Namely, 1.a, 2.a, b and c and 3.a and b. The remaining three focus on the trans-national shift in the services connected with the water supply and could relate to (imperfect) competition issues not addressed by this paper.

1. The Concession is not likely to provide a better service to citizens at a lower cost. This is mainly connected to the absence of competition.
2. The network rehabilitation process is likely to be poorly implemented, since enforcement of the concession is weak as are the economic incentives.
3. The arguments in favour of privatised water management have proven to be based on weak reasoning and are not confirmed by any evidence.
4. The reason for MoS to privatise its water supply is the lack of funds for rehabilitating the network.
5. Water can be supplied “economically” as any other commodity provided competition is ensured and externalities are corrected. This implies governmental monitoring and, in general, intervention. The ability of the authorities to ensure this is a precondition for an effective privatisation process.

Recommendations

According to what is stated above, the choice of privatisation as a way of improving service in the water sector can be criticised. Its realisation in Sofia has probably¹²⁶ still not met the goals¹²⁷ that justified its adoption in 1999. This section provides some recommendations and summarises the lessons learned in this case study.

1. Monitoring: before entering a privatisation process, local authorities have to ensure the establishment of an effective monitoring body. Especially with issues of central importance such as water. The convergence between private activities and public interest must be guaranteed.
2. Legality and transparency: clarity has to be ensured about the binding character of the investor’s commitment. Requisite for this is the transparency concerning the activities undertaken by the private operator.
3. Sound economic and financial analysis has to be performed: the crucial absence of competition in the privatisation process has been neglected by the authorities and this has put unrealistic expectations over the performance of the private party.
4. Social implications deserve higher attention: MoS expects SV to finance a huge investment campaign levying funds on a population experiencing acute poverty problems. This is plainly unrealistic; proof is the low rate of collection i.e. the high amount of unpaid bills¹²⁸.
5. Economic instruments and environmental issues have to be matched more carefully: a price based demand management can reduce water wastages but cannot reduce water losses, Sofia’s main problem.
6. Related to this case study, the environmental goals of the European WFD can be seen as plainly rhetorical, not relevant at best. Its financial goals play a dominating role in its implementation. This is particularly obvious considering the non-elasticity of water demand: prices merely inflate bills, rather than prevent water shortages.

¹²⁶ As anticipated above, the report on the effectiveness of the concession is overdue. See BGRF 2003.

¹²⁷ As reported in Section 4.a: “to significantly improve the levels of service through the introduction of modern management, operation and maintenance practices and execution of investment programmes required to rehabilitate and extend the existing systems”.

¹²⁸ See meif.org, 2004.

They enhance the financial pressure upon households budgets – thus potentially raising a very high amount of funds at a very high social price.

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4. Industry and transformation

4.1 The Canadian government, auto industry, and climate change: An examination of a proposed voluntary agreement on fuel efficiency and ghg emissions

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4.1.1 Introduction

Since signing the Kyoto Protocol, the Government of Canada (the Government) has been considering several types of initiatives to reduce greenhouse gas (GHG) emissions. The Government made a commitment to reduce GHG emissions to 6% below 1990 levels by 2008-2012. In order to meet this commitment, the Government must make a 240 Mega tonne (MT) reduction in GHG emissions from the projected “business-as-usual” emissions level of 2010 (GOC, 2002).

The transportation sector accounts for about 25% of Canada’s GHG emissions. As such, it has received considerable attention amongst policymakers in preparation of a climate change plan. In October 2000, the Government released *Action Plan 2000 on Climate Change*, where it proposed to achieve GHG reductions in the passenger transportation sector by, among other measures, launching negotiations with the automobile industry and the United States to achieve new vehicle fuel efficiency targets. The objective was to phase in a significant improvement in fuel efficiency across Canada and the US, starting in 2004 (GOC, 2000).

In its *Climate Change Plan for Canada*, released in 2002, the Government reiterated its commitment to reach a voluntary agreement with the auto industry. It indicated that negotiations were already underway for a 25% improvement in new vehicle fuel efficiency by 2010. This measure is expected to yield a reduction of GHG emissions of 5.2 MT per year (GOC, 2002).

As of today, the Government and the auto industry have yet to reach an agreement. The Government has publicly stated that if it cannot reach a voluntary deal with the auto industry, it will use regulatory measures.

In September 2004, the State of California announced a regulation that requires automakers to begin selling vehicles with reduced GHG emissions by 2009. The State of California’s decision has since amplified the debate in Canada on whether to regulate the auto industry or proceed with a voluntary agreement. Despite the proposed agreement’s relatively small contribution of 5.2 MT (out of 240 MT) of expected emission savings, this issue has garnered a lot of public and media attention.

In this context, a central question arises: What mix of policy instruments should the Government of Canada use to achieve GHG emission reductions within the auto industry? We propose to analyse this issue by first looking at the current actions being undertaken in Canada and other jurisdictions. We will examine why a voluntary agreement has so far failed to materialise and then present the theoretical background on different types

of policy instruments, mainly voluntary approaches. Finally, we will consider some specific issues that underscore this case, discuss the potential use of certain policy instruments, and, make recommendations on possible next steps.

4.1.2 Background

Current Action: Canada and Other Jurisdictions

In 2001, the United States (U.S.) administration of George W. Bush opted out of the Kyoto Protocol. This has since raised concerns in Canada about the practicability of moving forward with its Kyoto commitments while its largest trading partner will not have any Kyoto obligations. Despite these concerns, it should be noted that although the U.S. federal government is not participating in Kyoto, several individual States have their own plans for stabilizing and reducing GHG emissions. Among these is the State of California.

California Regulates Auto Industry

In September 2004, the California Air Resources Board (CARB) approved a landmark regulation that requires automakers to begin selling vehicles with reduced GHG emissions by model year 2009 (CARB, 2004). The standards are to be phased in gradually and only take full effect in 2016. By then, the estimates are that an average GHG reduction of 30% will be achieved on new cars and light trucks. The technologies required to meet these standards are expected to average approximately \$1050 of additional costs to new vehicles. CARB analysis concludes that fuel savings will offset the additional cost to consumers within 5 years. Furthermore, regulators insist that the technologies to meet its standards already exist in the form of such things as infinitely variable transmissions and engines that can shut down parts of themselves when extra power isn't needed.

Not surprisingly, automakers are contesting the new regulation. Nine automakers, under the Alliance of Automobile Manufacturers, have launched a lawsuit seeking an injunction to stop the State from enacting the regulation. The lawsuit contends that only the National Highway Traffic Safety Administration (a Federal body) has the authority to regulate fuel economy standards. California regulators attempted to sidestep this fact by regulating carbon dioxide emissions and not specifically fuel economy.

Unlike other states, California can set its own clean air standards because it began pollution regulation before the U.S. government. As such, other states must either adopt the federal standard or the CARB standard. Often, states choose to follow California's strict standards. New York and several Northeastern states have indicated that they plan on adopting CARB's new CO₂ regulation. However, given the uncertainty raised by the lawsuit, some states may opt to wait on the sidelines until the matter is resolved.

Europe's Voluntary Agreement

In 1998, the European Commission (EC) and the European auto industry reached an agreement on the reduction of CO₂ emissions from cars. The commitment was for automakers to achieve an average CO₂ emissions figure of 140 g/km by 2008 for all new cars sold in Europe. This represents an average reduction of 25% from 1995 levels (T&E, 2005). The agreement may also be extended to 2012 with a new target of 120 g/km. The

EC has also concluded similar agreements with the Japanese and Korean automakers, albeit with slightly different timeframes.

The EC's voluntary deal has been criticized on several fronts. In her analysis of the voluntary agreement, Keay-Bright of the European Environmental Bureau (EEB) questions the legal basis of the agreement (Keay-Bright, 2000). She states that while provisions exist to bring into force binding legal measures to regulate CO₂ emissions from cars, the EC instead chose to use non-binding recommendations. Furthermore, she points out that the EC does not have adequate tools at its disposal to apply sanctions or 'sticks' of some sort, which includes, not having prepared a legislative proposal (an effective stick) that could be used in case the voluntary agreement breaks down. Finally, Keay-Bright raised concerns about the lack of transparency of the agreement due to the exclusion of the European Parliament and environmental NGOs from the decision-making process.

The European Parliament, in January 2005, raised the issue of rising transport emissions and expressed its belief that "the EU could learn from California how to limit transport emissions". It also adopted a resolution calling on the EC "urgently to put forward proposals for binding CO₂ limits for new vehicles" (EP, 2005).

Moreover, recent reports (Kageson, 2005; EurActiv, 2005) indicate that automakers might not be able to live up to their voluntary commitments unless they make unprecedented emissions cuts. The expected report by the European Automobile Manufacturers Association for this year will show that only one European automaker is likely to meet the targets. Should this be the case, it will exacerbate the fact that the EC failed to properly implement its policy with adequate sanctions and binding targets.

If Europe's voluntary agreement falls short of its targets, critics may point to the failure of voluntary approaches while calling for more regulations, without necessarily examining why this agreement in particular failed. This could have negative repercussions for the future use of voluntary approaches.

Canadian Action on Transportation

While this paper focuses on the Canadian Government's negotiations with the auto industry for a voluntary agreement on new fuel efficiency targets, it is also important to mention the Government's other proposed measures that are aimed at the passenger (not freight) transportation sector.

- Launch consumer education campaign to help pull the market towards more environmentally friendly vehicles. This campaign aims to increase awareness and understanding of fuel efficiency in vehicle purchase, driving and maintenance practices.
- Initiate demonstration projects to allow both government and industry to learn more about refuelling technologies and infrastructure requirements for the commercialization of fuel cell vehicles.
- Increase ethanol blending to 25% and then 35% of gasoline supply by building on current tax exemptions for the ethanol portion of gasoline as well as federal funding for research and development.
- Initiate strategies to increase public transit use through improved urban planning, infrastructure investments, as well as other potential actions by federal, provincial and municipal governments.

These proposed 'actions' are included in the Government's climate change plan (GOC, 2002). The Government though has yet to release a detailed implementation plan and allocate budgets for these strategies.

The Government, in its March 2005 budget, did announce that it is also considering introducing new taxes on sports-utility vehicles (SUVs) and/or subsidies on high fuel efficiency vehicles such as hybrid gas-electric cars (Sallot, 2005). By taxing owners of fuel-inefficient vehicles and redistributing the money to drivers of fuel-efficient vehicles, the proposed measure should be revenue neutral.

Government and Industry: Failure to Reach Agreement

Five years after announcing its intention to negotiate an agreement with the auto industry, the Government has yet to deliver. There are a number of reasons behind this failure and we will attempt to explain a few. It is important to understand this in order to propose an improved approach to policymaking in this area.

First, it should be noted that the U.S. government's decision to withdraw from Kyoto in 2001 has no doubt had an effect on the Canadian Government's planning. As a prime example of this, in the initial *Action Plan 2000 on Climate Change*, the Government proposed to negotiate with the U.S. government and the auto industry for improving fuel efficiency standards across the U.S and Canada. However, when the Government released the subsequent *Climate Change Plan for Canada* in 2002, the U.S. government was no longer mentioned in its proposal.

Auto Industry Resistance

In response to the Government's *Action Plan 2000 on Climate Change*, the auto industry released a discussion paper regarding the Government's proposed measures. The paper highlights the negative effects on the Canadian economy that would result from Kyoto ratification. Among other assumptions, the paper points to job losses in the tens of thousands in the auto industry, loss of competitiveness, a shift of investments to non-Kyoto countries (U.S., Mexico), increased vehicle costs, and decreased consumer satisfaction (CMVA, 2001). In addition, the industry claimed that the Government's CO₂ reduction targets through fuel efficiency improvements were too ambitious.

The auto industry's discussion paper explains its opposition to the Government's climate change policies. The industry's analysis and critique of the governmental proposals serves notice that negotiations would no doubt be difficult. Of course, the arguments presented here against Kyoto ratification are simply part of the industry's public relations campaign to protect its interests.

In the U.S. and Canada, markets trends for vehicle ownership since 1990 show that SUVs, minivans and light trucks have been continuously increasing their share of the auto market. In the U.S. alone, this segment of the market now accounts for 50% of new vehicle sales (Kageson, 2005). It is widely known that automakers make considerably more profit per vehicle on sales of SUVs and trucks as opposed to small cars. For this reason, automakers put a lot of resources and investments to aggressively promote that segment of auto market. Shifting investments towards the development of more fuel-efficient vehicles does not make business sense in the short-term while demand for SUVs remains strong. "A major concern for the automobile industry was that any actions

to regulate fuel economy might threaten their most profitable market segments which generally consist of cars that are more luxurious, larger, more powerful, faster and therefore more fuel inefficient than the average car” (Keay-Bright, 2000). As such, auto-makers have an interest in delaying any action that would require a shift of resources towards increasing fuel efficiency.

Finally, another obstacle is the fact that car manufacturers are not considered final GHG emitters in this case. They are not being asked to cut their own emissions, which may be of self-interest. Instead, they are being asked to cut the emissions that result from the use of their products. Clearly there is little incentive for them to do so, especially given that current markets forces (see trends above) do not support this action.

Government Resistance

It has become evident through several media reports that the auto industry is ready to strike a deal and has presented the Government with a plan to meet the CO₂ targets. The Government though has yet to accept the auto industry’s offer. Clearly, it is the Administration that is now dithering on the issue. The overriding reason behind this is disagreement within Government on the use of a voluntary approach.

The Ministry of Environment Canada (EC) is the lead department on the climate change file. Other ministries such as Natural Resources Canada (NRCan), Transport Canada (TC) and Industry Canada (IC) are also involved. Fuel economy and energy issues have always been under the purview of Natural Resources Canada. The main stumbling block, which has become even more acute since California’s announced regulation, is whether to accept a voluntary agreement or proceed with regulations. NRCan and IC have reportedly accepted the auto industry’s proposal while EC and TC still favour regulations (Keenan, 2005). Despite this, publicly, the Government has stated that it still plans on reaching a voluntary deal.

We offer another reason for the Government’s resistance. According to Maclean’s magazine, “Canada’s automakers have recently handed Ottawa a plan for hitting the federal target. But instead of relying only on a shift to selling more cars that burn less fuel, they are proposing such wrinkles as more efficient automotive air conditioners” (Geddes, 2005).

The refrigerant used in automobile air-conditioners, known as HFC-134a, is a greenhouse gas that is even more damaging than CO₂. An improved air-conditioner could contain the gas better or, alternatively, a different type of refrigerant could be used.

Environmentally speaking, the Government should not care about how the auto industry achieves to reduce 5.2 MT of GHG. However, the authorities also have to worry about the views of the electorate. It had promised to make a deal that would increase fuel-efficiency by 25%, which would translate into long-term savings to consumers despite the expected increase in vehicle prices. Thus, the Government would be able to promote a good public policy of welfare maximization with both environmental and financial benefits. On the other hand, if automakers achieve GHG reductions by also improving air conditioners, then there may not be as much financial benefits to consumers. As such, the Government may have wanted to not only stipulate the environmental targets

but also the technology standards. We believe this may have also impeded a potential deal.

4.1.3 Policy Theory

Public Policy Instruments

Public policy instruments can be defined as “the set of techniques by which governmental authorities wield their power in attempting to ensure support and effect social change” (Maged, 2004). The techniques, based on the level of force (coercion) used in the governance, can be classified into three categories: regulations, economic instruments, and information.

Regulation is often described as a command and control technique. Regulations place constraints on the regulated parties and often involve specified standards (i.e. for levels of emissions or even technologies). Parties that violate the rules, or standards, are considered to be behaving illegally and are subject to penalties (Kahn, 2005).

Economic instruments, rather than regulating behaviour, attempt to make self-interest coincide with social interest (Kahn, 2005). They often involve either incentives (carrots) or sanctions (sticks), but the subject remains free to choose whether or not to take action. Economic instruments, such as tradable permits or taxes, have flexibility in mind and allow market forces to play a decisive role.

Finally, information as a policy instrument can be described as any sort of education and communication campaign. By raising awareness and understanding of environmental issues, information can be a form of moral suasion. “Empirical evidence, though not conclusive, indicates that the provision of information indirectly affects markets by generating pressures – investor, influence, public concern, reputation and the like – that influence corporate behaviour towards better environmental performance” (Maged, 2004).

Voluntary Approaches

Voluntary approaches do not necessarily belong to any of the categories mentioned above. Depending on design, they can embody one or more of the three categories.

Definition

Segerson and Li define a voluntary agreement as “an agreement between government and industry to facilitate voluntary action with a desirable social outcome, which is encouraged by the government, to be undertaken by the participant based on the participant’s self interest” (Segerson, 1999). There are three categories of voluntary programmes or initiatives: unilateral initiatives undertaken by firms; bilateral agreements between government and firms; and voluntary programmes designed by the government to induce participation by firms.

Unilateral initiatives are the most basic of voluntary approaches. Actions are undertaken by firms or by industry groups out of self-interest. They generally identify a business opportunity associated with increased environmental stewardship. This form of self-regulation does not involve governments.

Bilateral agreements result from direct negotiations between public authorities and industry. Such agreements can include a range of instruments (sticks and carrots) to induce participation and may or may not include binding targets. The Canadian Government's negotiations with the auto industry would fall under this category.

With voluntary programmes, the government simply designs the programme including eligibility, rewards and obligations of participation. Firms decide whether or not they wish to sign on.

Voluntary Approaches vs. Regulations

Voluntary approaches, such as environmental performance negotiated with industry, are increasingly supplementing or replacing other environmental policy instruments such as regulations and taxes. With respect to the auto industry's case, environmentalists and bureaucrats continue to debate whether to regulate or sign a voluntary agreement. These two approaches should not, however, be regarded as substitutes for each other.

Officially, the Government acknowledges that a voluntary agreement would be the preferable alternative with regulation being a fallback position, or potential backstop. This view generally fits in most theoretical notions that both approaches are complementary (Segerson, 1999; Maged, 2004). The threat of regulation is seen as a good coercive measure to bring voluntary compliance. Indeed, it seems that the auto industry may have been more receptive to an agreement once the Canadian Government began considering the California regulation. Equally, a regulation can also be used to make a voluntary agreement binding and give governments sanctioning powers, something the EC has apparently failed to do.

Having said that, it can therefore be argued that voluntary participation is not wholly voluntary. Whether it's the threat of future regulations or sanctions, market pressures, other economic instruments, or simply an identified business opportunity, firms acting rationally are thus more willing to voluntarily engage in environmental stewardship. Consequently, voluntary compliance needs not be seen as the opposite of coerced compliance through command and control (CAC) techniques. Rather, voluntary approaches are simply less coercive instruments than direct regulation (Maged, 2004).

As such, voluntary approaches should not be viewed as substitutes to other instruments, but rather as helpful additions to the policy and regulatory frameworks. In that regard, the debate in Canada becomes increasingly redundant as it is based on false perceptions of the policy tools.

Effectiveness

Segerson and Li (1999) suggest that voluntary approaches offer advantages such as increased flexibility and reduced compliance and transaction costs. They also offer the promise for changing organizational culture and behaviour, which may be crucial for sustained environmental improvements. Consequently, they have the potential to fill the vacuum of environmental policy as governments recognize the limitations of regulations.

Theoretical and empirical literature however suggests that purely voluntary strategies might not be very effective in inducing significant pollution abatement (Segerson, 1999). Indeed, an OECD report published in October 2003 (OECD Observer, 2003) questions

the environmental effectiveness and economic efficiency of voluntary approaches. The report notes that there are few cases where such approaches have improved the environment beyond a business-as-usual baseline. It also points that administrative and transaction costs vary greatly between different voluntary approaches.

Notwithstanding, voluntary approaches have potential when properly implemented. On this issue, Segerson and Li (1999) also suggest that effectiveness can be enhanced through the threat or the actual implementation of background legislation. Other important design characteristics that can enhance effectiveness include: clearly defined and realistically attainable environmental targets; binding agreements; transparency from all parties involved; negotiations and terms of agreement made public; and public participation in the decision making process (Maged, 2004). These characteristics are not definitive and do not guarantee success. There are no doubt different sets of characteristics that can be selected. We simply identify a few for the purpose of our discussion.

There is however one important element that policymakers should keep in mind when negotiating and designing a voluntary agreement: chances of success increase dramatically if there is a strong underlying business case¹²⁹ to support a firm's voluntary participation.

4.1.4 Discussion

The purpose of this discussion, given the Government's failure to conclude an agreement with the auto industry, is to highlight several issues that policymakers need to take into consideration for future negotiations.

Considerations

Transparency

In its 2004 *Kyoto Report Card*, the Sierra Club of Canada (2004), a leading environmental NGO, criticizes the Government on the lack of progress in the negotiations with the auto industry: "After two years of secret negotiations, carmakers refused to boost the fuel economy of their vehicles". As in Europe's voluntary approach, there is undoubtedly a lack of transparency from all sides with respect to these negotiations.

There have not been any efforts on the part of the Government to demonstrate accountability on this issue. Aside from some reports leaked to the media, the public has not been given any information regarding the negotiations. Furthermore, there are no environmental NGO's or public interest groups involved in the negotiations. This is unfortunate, especially the exclusion of third parties that could have helped facilitate or bridge differences. Had Government been transparent on this issue from the outset, an informed public may have exerted enough pressure (market or public) to induce a faster resolution.

¹²⁹ Business case, meaning that there is an opportunity for the firm to make a return on investment, either short term or long term.

Harmonization of North American Standards

It is important here to understand the global nature of the auto industry. In North America the auto industry is highly integrated. Cars produced in Canadian plants are exported to the U.S. and vice versa. As such, it has always been important to maintain harmonized standards in all North American jurisdictions. For this reason, many states would often adopt California's strict air quality rules, thus effectively creating a new North American standard. The Canadian Government understands this and knows it cannot impose radically different standards on its own. As one auto industry executive said, "The Government needs to understand that the size of the Canadian market is insufficient to drive vehicle design" (Geddes, 2005).

As a result, environmental groups, as well as some government officials, are arguing that the Canadian Government should drop its efforts to negotiate a voluntary agreement and adopt legislation similar to California's. They note the fact that several Northeastern states (including New York) are currently considering it. If Canada and the Northeastern states were to adopt the California regulation, the new rules would cover a market of over 100 million consumers. Such market coverage would probably be large enough to make the new rules soon the *de facto* North American standard. There remains of course the issue of the auto industry lawsuit against the new legislation. The industry is perhaps hoping that having taken legal action against California, it would dissuade other states from adopting the legislation. It remains to be seen whether this tactic will delay the implementation of the new rules.

Monitoring

Governments must consider monitoring costs when choosing policy instruments. In this case, it is worth noting the relative ease in which monitoring and enforcement can be applied. There is a long standing history between Government and the auto industry. The industry is already heavily regulated and is constantly being monitored by regulatory agencies, consumer groups and insurance companies for various reasons from safety and security to performance standards. Third party monitoring, through tests on crash worthiness and fuel efficiency for example, has existed for a long time and the information is always made public.

The existing monitoring supports the use of voluntary approaches. Indeed, direct command and control policies are generally considered preferable when monitoring is difficult and costs are high (Kahn, 2005). This may explain why the Government has been relying more and more on voluntary agreements with the auto industry. In his speech to parliament, the Minister of Natural Resources pointed out that the auto industry had already honoured 14 previous voluntary agreements in the past (Bueckert, 2004).

In this context, the Government's ability to negotiate and implement environmental policies should be straightforward in comparison to other industries. The availability of third party monitoring leads us to question again whether the involvement of public interest groups may have made a difference in helping push negotiations forward.

Long Term Structural Changes

The Government's ongoing efforts to usher in new fuel efficiency improvements give emphasis to the continued reliance on internal combustion technologies and do little to

promote alternative powertrains, such as fuel cell or hydrogen technologies. In fact, the continued debate about fuel efficiency standards simply delays any discussion about the real challenge of moving away from fossil fuels and adopting alternative technologies. By concentrating most of its efforts on reaching short-term goals on fuel efficiency, the Government is essentially keeping the issue of alternative technologies off the top of the agenda.

The auto industry has shown its resistance to using available technologies to simply improve fuel efficiency. Given this, and given the likely significant structural changes that will be required to shift production to alternative technologies, the Government should be more concerned about developing a long-term strategy.

Aside from the proposal to initiate demonstration projects on refuelling technologies (see Section 4.1.2), the Government has not put forward any meaningful proposals to address the long-term structural changes that will be needed to bring the new technologies to the market place sooner. The auto industry claims that historical trends show that new technologies require 25-30 years for full market absorption (CVMA, 2001). The Government needs to initiate discussions with the industry to formulate a strategy with respect to the next steps that will be required in this transition. This will require setting objectives beyond 2010. The auto industry needs to be given the right signals so that it can begin planning well in advance given the lengthy lead-times necessary.

Examination of Potential Policy Instruments

Market Intervention

Keay-Bright (2000) of the European Environmental Bureau argues that voluntary agreements should not be applied to industries whose market trends are moving in the opposite direction to the one desired in order to achieve environmental objectives. While her concerns are well founded, the continued pursuit of a voluntary agreement by the Government should not be ruled out. Nevertheless, given the auto market trends in North America, the Government needs to implement a policy mix that will also play a role in changing market demand.

The Government's proposal (called 'Feebate') to introduce subsidies/taxes on certain cars is a market-based instrument that may get the market moving on fuel efficiency. Some provinces have already introduced subsidies for hybrid gas-electric cars ranging from \$1000-\$2000. If the federal government would do the same, it can create significant positive inducement to move the market towards more fuel-efficient vehicles. Hybrid cars currently cost 20-30% more than comparable fuel injection models (Kageson, 2005). In the U.S., individuals who purchase hybrids receive a \$3,500 tax rebate. One industry executive pointed out the success of the policy stating, "we can't keep Escape Hybrids in the showroom in the U.S" (Keenan, 2005). Coupled with a tax on large fuel inefficient vehicles, such a policy could be quite effective while remaining revenue neutral.

The Government can also consider increasing fuel taxes but this measure is highly unpopular. Also, such a tax is considered regressive, that is it disproportionately affects lower income individuals. Nevertheless, the Government does have some room to make

gradual increases over time as Canadians enjoy some of the lowest fuel prices in the world.

It has also been suggested that the Government intervene even further in the market and introduce some sort of tax credit or other type of incentive for automakers for each hybrid-electric or fuel cell car sold. Such a measure could make the sale of fuel-efficient vehicles highly profitable for automakers. As such, they would have a good business case to use their marketing power to promote that segment of the market. By intervening on both the demand and supply side, the Government would create significant market based inducement that could considerably speed up the market penetration of hybrid-electric and fuel cell vehicles. But at what cost?

While we support the use of the revenue neutral 'Feebate' proposal, we do not believe the Government should subsidize automakers. Such a measure can become quite expensive and may be very unpopular with voters. The electorate does not like to see billion dollar industries given Government handouts that would help them increase profits. Besides, subsidies are not a sustainable solution to achieve the long-term structural changes that are required. Long-term goals would be better served by having the Government make R&D investments together with industry to bring to market alternative technologies sooner.

Tradable Permits

In the long-term, a tradable permit system can be considered for the North American market. Again, due to the integrated nature of the industry and the available monitoring, such a system can likely be implemented at very little cost. The proposed system can only be effective on a continental scale and is therefore highly dependent on the participation of the U.S. federal government. The Canadian Government (and Europe) is no doubt hopeful that the future White House administration will decide to play a more active role in the climate change fight.

In a tradable permit system, governments can set CO₂ emissions standards on a per vehicle basis. Let's assume an emissions standard of 100 g/km of CO₂ per car. This would be a harmonized North American standard. If, for example, 20 millions cars are sold in North America on a given year, then 20 million (100 g/km) credits would be available to automakers depending on their individual sales. Ford, for example, would be allocated 7 million credits, while Toyota would receive 5 million. If Ford's vehicles are not very fuel-efficient and average 115 g/km of CO₂, then Ford needs 8.05 million (100 g/km) credits. If on the other hand, Toyota sells more fuel-efficient cars that average 79 g/km of CO₂, then it only needs 3.95 million (100 g/km) credits. Toyota can therefore sell its extra credits to Ford or another automaker. Ford on the other hand could choose to continue buying credits or invest to make its vehicles more fuel-efficient. This simple example of a tradable permit system shows that the idea merits future consideration.

4.1.5 Conclusion and recommendations

In the light of our theoretical examination of policy instruments and the discussion on the key issues that accentuate this case, we conclude that the debate on whether to use voluntary agreements or regulations is not sound. The persistent rhetoric coming from within Government and environmental NGO's is useless, as it is based on incorrect un-

derstanding of the policy and regulatory frameworks. This has contributed to delays in moving forward with the announced measures to reduce GHG emissions. We have established that voluntary and regulatory approaches can be used together and are complementary policy instruments. There is no rationale in allowing this debate to continue, when clearly, the two approaches are not mutually exclusive.

We therefore offer several recommendations in order to move ahead in this area of policymaking. The recommendations include a mix of policy instruments that are designed to achieve GHG emission reductions within the auto industry.

Short-Term

If the auto industry, as recently reported, is ready to sign a voluntary agreement concerning the Government's CO₂ emissions targets for 2010, but not necessarily on fuel efficiency, then the Government should accept this. Given the shortened timeframe, the Administration should give industry the flexibility to first move forward at the lowest abatement cost. If the CO₂ targets of 2010 can be achieved, the auto industry should not be weighed down with additional requirements with respect to technology standards. The Government, for its goal of fighting climate change and improving the environment, should only be concerned with CO₂ emissions and not fuel efficiency. They should allow market forces to dictate fuel efficiency.

Also with respect to the agreement, the Government should ensure that the CO₂ targets are binding, and, along with industry, demonstrate some accountability by making the terms of the agreement public.

It has been argued that the auto industry has a good track record of honouring voluntary agreements with the Government and, as such, regulations would not be necessary. Despite this apparent history of goodwill, it may be prudent for the Government to nevertheless draft a regulation as a backstop measure. The regulation could ensure that the regulatory agency has the adequate sanctioning powers should the auto industry fail to meet its commitments. The regulation need not be enacted, simply drafted and made public. It should only be passed into law if absolutely necessary. This should provide enough negative inducement for the auto industry and give regulators peace of mind that their hands are not tied if the agreement is breached.

As stated, the Government should allow market forces to influence fuel efficiency standards. This, however, does not preclude intervention to help move the market in the right direction. As such, the Government should, as soon as possible, introduce its 'Feebate' market based instrument to help move the market towards more fuel-efficient vehicles. This measure should be implemented along with the previously announced consumer education campaign to increase understanding of fuel efficiency concerns. The combination of economic incentives and information campaigns can be quite effective because such an approach would influence consumer behaviour, which in turn would influence producers.

Finally, after reaching an agreement with the auto industry on the CO₂ targets for 2010, the Government should swiftly initiate negotiations for longer-term targets. With 2010 fast approaching, new CO₂ targets for 2016 and 2020 need to be established given the auto industry's resistance in this area and the required lead-time necessary to introduce

new technologies. These negotiations should include stakeholder and public participation on a certain level. We do not attempt in this paper to determine the appropriate level of public participation. We maintain that the lack of transparency was a shortcoming of the previous negotiations and therefore increased public participation could be beneficial. At a minimum, information on the negotiations must be made public at all times.

Long-Term

The Government should engage the U.S. federal government to develop a coordinated future strategy for the long-term improvements in air quality. This could include the creation of a joint committee that could conduct future negotiations with the auto industry on behalf of both governments. Such an approach can help ensure that North American standards remain harmonized in the future, also giving governments the extra bargaining power of their combined markets and jurisdictions.

The joint committee would also need to be transparent with a public stakeholder process including labour, industry, and public interest organizations. By including labour and industry, work can begin on the design of a long-term strategy to address the needed technological, social and regulatory changes that will be required to allow for a smooth transition to alternative technologies. Equally, a study on the merits of a tradable permit system should also be initiated as part of this long-term strategy.

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4.2 Voluntary Agreements in China: Review of the past and suggestions for the future

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4.2.1 Introduction

Nowadays, China faces a significant challenge to continue providing essential materials and products for a rapidly growing economy while addressing pressing environmental concerns. Confronting the potential energy crisis and fierce international competition,

both the Government of China (the Government) and the industrial enterprises must co-operate to take effective actions towards the improvement of energy efficiency.

Internationally, a number of countries have achieved significant energy efficiency improvements in the industrial sector through “Voluntary Agreements”, an innovative policy mechanism. Given the significant success that this has implied, the Chinese Government decided to introduce voluntary agreements into the industrial sector to test their applicability in China. The first project, the *Energy Conservation Voluntary Agreements Pilot Project*, with two iron and steel enterprises in the Province of Shandong, was modeled in 2003 after taking China-specific conditions into consideration.

In this report, after briefly analyzing in Section 4.2.2 the current situation of industrial energy consumption in China, the content of the pilot project will be described in more detail in Section 4.2.3. Afterwards, Section 4.2.4 will evaluate the design process of the pilot project according to normative criteria suggested by the International Energy Agency and the European Commission. The purpose of the review is, besides assessing the pilot project itself, to put forward suggestions for future work in this area.

4.2.2 Industrial energy consumption situation in China

In this section I will try to answer two questions. First, if it is possible for the Chinese industrial sector to improve energy efficiency; and if so, whether it is desirable to do it now.

Energy is a fundamental element of a nation's economy and the conditions of its use have a direct impact, in this case, on China's ability to reach its sustainable development goals. Chinese industrial sector, which accounts for over 70% of the country's total yearly energy consumption, provides materials such as steel and cement to build up the nation's infrastructure. Industrial products include all the components of everyday life in an increasingly modern society. This vital production of materials and products comes with considerable problems. Chinese industrial sector is heavily dependent on coal resources. Industrial production pollutes the air locally with particulate emissions, carbon monoxide, sulphur dioxide, and nitrogen oxides, uses scarce water and oil resources, emits greenhouse gases contributing to the global warming, and often produces hazardous and polluting wastes.

During the past 20 years China experienced an average annual increase of 4-5% in energy consumption, while maintaining an average annual economic growth of 8-9%. This contributes to the realization of the macro-goal of meeting increased energy demand half through energy development and half through energy saving (Xie, 2002). However, a huge gap remains between China's energy efficiency level and that of the world's most advanced countries. China's energy consumption per unit of GDP is more than two times higher than the world average. Energy consumption for production of the main energy-intensive products in China is 40% higher than in international consumption (Lynn Price et al, 2003). Table 4.1 provides a comparison of the Chinese energy intensity with the international advanced level in 1998, for a number of key energy-intensive industries.

Table 4.1 Comparison between Chinese and International Advanced Level Energy Intensity for Selected Industries, 1998.

Industry	China (GJ/tonne)	International Ad- vanced Level (GJ/tonne)	Ratio (China/International)
Iron and Steel	27.5	19.3	1.43
Cement	4.2	2.9	1.45
Large Synthetic Ammonia	40.6	27.8	1.46
Alumina-Bayer Method	16.6	14.7	1.13
Alumina-Complex Method	44.5	19.0	2.34

Source: Lynn Price et al, 2001.

Since China's industrial level of energy efficiency is much lower than the international advanced level, we can state that it is possible to improve energy efficiency in the Chinese industrial sector. But improving energy efficiency requires investment on advanced technology and new facilities; is it desirable to do this now?

China is experiencing a transformation from planned economy towards a market economy, where governmental control is weakening and enterprises are becoming more heavily influenced by market forces. Becoming China a Member State of the World Trade Organization (WTO) provides new rules and new challenges for Chinese industries, pushes them into the international arena and allow more foreign enterprises to enter China's domestic market. All these, means increasing competitive pressures for Chinese industries because of foreign low-price and high-quality products.

The pressures of rapid industrial production growth, continued environmental degradation and increased competition, create a situation that calls for a strategically planned evolution of Chinese industries into world-class production facilities that would make them competitive, energy-efficient and less polluting. Such a transition requires the complete commitment of the industrial sector and the Government to work together for the transformation of the industrial facilities of China.

4.2.3 Voluntary agreements pilot project in Chinese industrial sector

During the last two decades, a number of countries have achieved significant energy efficiency improvements in the industrial sector through "Voluntary Agreements", an innovative policy mechanism. Given their significant success, China's State Economic and Trade Commission (SETC) chose voluntary agreements, based on the negotiated agreements model, as a new policy mechanism to be tested in Chinese industrial sector. In this sector, the transition towards a market economy is demanding innovative methods for supporting and transforming essential enterprises. Analysis of the potential to improve energy efficiency, among various energy-intensive industries in China, led to the choice of the iron and steel industries for a pilot project to evaluate this new policy instrument. Jinan Iron and Steel Company (Jigang) and Laiwu Iron and Steel Company (Laigang) were the chosen enterprises to take part in the pilot project. This project is directed by the Economic Trade Commission (ETC) of the Province of Shandong and is undertaken with the participation of independent organizations such as China Energy Conservation Association (CECA).

Setting energy efficiency targets

In this pilot project energy-efficiency targets are set through a process in which Government and enterprises negotiate the target level, based on detailed evaluations of the potential for energy-efficiency improvement of each enterprise. The energy efficiency potential is determined by identifying inefficient processes within each enterprise and technologies and measures that could be implemented to improve their energy efficiency, based on the availability of technologies and cost-effectiveness criteria. The potential energy intensity reductions, associated with the implementation of these technologies and measures, are estimated to determine the achievable energy-efficiency potential, which is in turn used to set the targets of the Energy Conservation Voluntary Agreement pilot project.

The energy efficiency targets are set by first developing the business-as-usual scenario and then, using the information from the assessment of enterprise energy-efficiency improvement potential, calculating the additional energy efficiency that could be achieved with the Voluntary Agreement.

Establishing supporting policies

While the enterprises are assessing their energy-efficiency potential, the Shandong ETC formulates a list of possible supporting policies that can be offered to the participating enterprises to assist them in achieving their targets.

Shandong ETC selected supporting policies that are suitable for China's conditions and that promote enterprises' participation in the Voluntary Agreement program, as well as aid enterprises to achieve the energy-conservation targets. These supporting policies are: "1) give priority consideration to the two pilot enterprises under existing preferential policies, 2) coordinate the provision of guarantees by the provincial guarantee company for loans and other financial activities required for energy-efficiency projects at the pilot enterprises, 3) use various media to publicize the energy-conservation achievements and contributions of the pilot enterprises, 4) organize intermediary organizations to provide the pilot enterprises with policy, technical, management, and other advice and services, and 5) upon evaluation, exempt the pilot enterprises from monitoring of the status of energy utilization" (Shandong ETC, 2003).

In addition to the supporting policies offered by the local government, at the national level SETC is requested to provide the following supporting policies: "1) for energy-conservation benefits realized through energy-conservation projects, and in accordance with resources comprehensive-utilization policy, investigate and propose recommendations for preferential policies to encourage energy conservation, 2) give priority support to projects undertaken by the pilot enterprises that fulfil the criteria set by national preferential policies, 3) grant a portion of research and development costs for projects undertaken by the pilot enterprises that have significant results in energy and resource conservation and comprehensive utilization, short payback times, and outstanding economic and social benefits, to support enterprises to carry out energy-conservation research and development, 4) give priority to the pilot enterprises when bringing in foreign investment capital, 5) award pilot enterprises the honourable title of "*China Energy-Efficiency Voluntary Agreement Pilot Enterprise*" (Shandong ETC, 2003).

Signing the voluntary agreement

After the energy conservation targets were set and the supporting policies established, the enterprises and the Shandong ETC signed the voluntary agreement. The signing of the Shandong Province Pilot Project Voluntary Agreement took place in the spring of 2003.

4.2.4 Review of the pilot project and suggestions for the future

Assessment criteria selection

Since voluntary agreements are new policy instruments, the experience and evaluation of these agreements is scarce. Also, theoretical insights about voluntary agreements are limited (Kirsten Hansen, 1999). However, various organizations, including OECD and UNEP, have set up common criteria or key elements for successful voluntary initiatives (UNEP, 2000).

Because the pilot project is still ongoing and no valid implementation data can be found on the Internet, it is difficult to evaluate the effectiveness and impacts of the pilot project. Considering this, the following review will focus on the assessment of the design process of the pilot project. Seven normative criteria suggested by the International Energy Agency and the European Commission will be adopted to evaluate the design process.

Normative criteria assessment

An assessment of the design process of the pilot project according to seven normative criteria based on Ekins (1998), Kræmer and Hansen (1998) and IEA (1997) is presented as follows.

1. The government should have an agency close enough to industry to understand both the concerns and potentials of business, but in turn under the control of an upper administrative branch to limit collusion.

In the pilot project, there is a governmental agency close to the industry -Shandong Economic and Trade Commission (Shandong ETC) - under the direction of the State Economic and Trade Commission (SETC). But the role of the governmental agency is rather generally administrative. It determines which supporting policies to include in the pilot project to assist the enterprises in reaching their energy-efficiency targets, but does not know exactly which are the business's concerns and potentials.

In this scheme, the mechanism which could limit collusion is the participation of the third party (CECA and Technical Team), connecting industrial enterprises and the governmental agency forming a triangle among these three parties, which could make the entire process more transparent.

2. A clear statement should be presented concerning rights and responsibilities of all parties; and improvement targets and procedures should be clear for the participating companies

Since this pilot project consists just of voluntary agreements between the Government and two individual iron and steel enterprises, the rights and responsibilities of all concerned parties are clear. The interim targets of the two iron and steel enterprises are

shown in Table 4.2. In addition, all the benefits and obligations of the Government and the third party (CECA) are also clearly stated in the agreements.

Table 4.2 Voluntary Agreement's Energy Intensity Interim Targets and Energy Conservation Rates for Jigang and Laigang Steel Enterprises.

	Indicator	2000	2005
Jigang	Comprehensive energy intensity (kgce/t steel) ¹³⁰	813	735
	Comparable energy intensity (kgce/t steel)	730	660
	Annual energy conservation rate, 2000 to 2005		-2.0%
Laigang	Comprehensive energy intensity (kgce/t steel)	872	715
	Comparable energy intensity (kgce/t steel)	707	655
	Annual energy conservation rate, 2000 to 2005		-1.5%

Source: Lynn Price May, 2003.

The improvement procedures of the two participating companies are defined as follows. Implementation of the Energy Conservation Voluntary Agreement begins with the development of an Energy Conservation Plan, by each enterprise, which outlines the steps to be taken in order to reach their targets. Once the Energy Conservation Plan is developed, CECA and the Technical Team will evaluate the Plan to ensure that it outlines the required energy-efficiency improvements to reach the targets. While the enterprises are developing the Energy Conservation Plan, Shandong ETC and SETC will take the necessary actions to ensure that the supporting policies are in place and that the enterprises can take advantage of them during the implementation of the Energy Conservation Plan.

3. Environmental interest groups should be sufficiently organized and informed concerning the environmental performance and potentials of companies and industrial sectors.

In the pilot project, there is no environmental organization involved in any part of the process. According to the results of the assessment of Five Voluntary Agreement Projects (Dutch, Finnish, Danish, British and Swedish schemes), these five projects are successful although environment organizations do not play important roles in the whole process. Furthermore, there is no critical and powerful environmental NGO in China. The responsibilities for environmental protection are taken by the Chinese Government.

In the future, the State Administration for Environment Protection could be involved in the voluntary agreements. Its role will be different depending on the scheme of the agreement. When the overall general targets are negotiated in a kind of alternative democratic process, the State Administration for Environment Protection should counter-balance the industrial interest to force them to set higher targets. When the targets are set

¹³⁰ Comprehensive and comparable energy intensity are two standard Chinese intensity metrics. The comprehensive energy intensity metric includes all plant energy use, including uses not directly linked to the production of steel such as for employee homes and schools, as well as other on-site facilities. While comparable energy intensity normalizes production relative to the ratio of iron and steel production in order to provide a metric to compare steel plants within China and with plants in other countries.

through legislation, the State Administration for Environment Protection could play a role in the monitoring of the agreements.

4. Before adapting reduction target procedures or investment criteria an independent estimation of the implications of business as usual should be made.

To create sensible targets at national level, an independent estimation at sector or company level seems logical in a rational policy process. Independent estimations of business as usual are seen as part of an evaluation (e.g. Rietbergen et al., 1998 and Togeby and Hansen, 1998). In the pilot project, evaluating the proposed energy-efficiency targets to determine if they are beyond business-as-usual is the responsibility of the Technical Team.

In addition, the Technical Team is responsible to give technical assistance during the enterprise assessment of energy efficiency improvement potential. It should be noticed that, according to the international experience, the energy potential assessment is supposed to be conducted by an independent organization. For instance, in the Dutch Long-Term Agreements on Energy Efficiency, the preliminary assessment of the energy efficiency potential of each industry was made by an independent governmental research agency (Nuijen, W., 1998). But in the pilot project, the participant enterprises evaluated their preliminary energy efficiency improvement potential themselves; afterwards, the discussions and negotiations between the enterprises and the Government were based on these results. The Technical Team gave technical assistance while assessing the process; however, given the assumption that the industry wants rather weak targets (AKF Forlaget, August 1999), we have reasons to believe that the results of self-evaluation are somewhat not reliable and that they do not represent the best energy-efficient performance that these two enterprises could achieve.

5. A system involving concerned parties, independent of industry, should be established to monitor and verify progress towards, and the achievement of targets.

The pilot project has in place an effective supervision and evaluation system. CECA will convene a Leadership Team, an Implementation Management Team, and a Technical Team to oversee implementation of the Energy Conservation Voluntary Agreement Pilot Project. In order to provide all participants in the Voluntary Agreement with information regarding the implementation of the Energy Conservation Plan and the achieved results, at the end of each year the enterprises will submit annual reports that provide detailed information on their energy-efficiency improvement progress. In addition to these annual evaluations, interim and final evaluations of the results of the implementation of the Energy Conservation Plan will be performed in 2005 and 2010, respectively. The evaluations will determine if the target has been met. Following the interim and final evaluations in 2005 and 2010, all parties will decide how to proceed. In 2005, this will involve deciding to develop 2010 targets and Energy Conservation Plans for 2010. In 2010, it will imply deciding whether to proceed with a new Energy Conservation Voluntary Agreement.

6. Broad sector coverage and participation from both large and small companies and support from sector associations should be present.

Because this pilot project only includes two iron and steel enterprises, it is hard to evaluate it against this criterion.

Since the voluntary agreement started with iron and steel enterprises, it intends to cover the entire sector of iron and steel prior to involve other sectors. In general, the most significant iron and steel enterprises are located in four provinces and one municipality in China. The related information can be seen in Table 4.3 below.

Table 4.3 Distribution and Capacity of important steel plants in China.

Location	Number of Industrial Enterprises in iron and steel sector	Capacity of Steel Plants (Million Tons)
Shanghai Municipality	4	7
Shandong Province	4	15
Jiangsu Province	5	4
Liaoning Province	8	14
Hebei Province	7	10

Source: Jiang Yun et al, 2003.

Although the Provinces of Liaoning and Hebei have more steel plants and more steel capacity, the enterprises from the Province of Shandong were the ones chosen as the participants in the pilot project. One main reason is that the level of economic development of Shandong is considered among the first-class in China, and there is a large potential for economic development. This is also very beneficial to the popularization of the experiences around the pilot project. In other words, the pilot project in Shandong seemed to have more chances of success than in the other provinces.

The real problem ahead is how to spread voluntary agreements into steel enterprises in Liaoning and Hebei where there is more production capacity but a relatively lower level of economic development. This will be discussed in more detail in Section 4.2.5.

7. There should be a mechanism for imposing sanctions in the event of noncompliance.

After reading the voluntary agreements carefully, I could not find any provisions regarding sanctions in the case of non-compliance. A probable reason could be that the Government believes the two enterprises will comply with the agreements, otherwise they would have not chosen these two enterprises to be involved in the pilot project.

However, a mechanism for imposing sanctions in the case of non-compliance should be included in complete voluntary agreements in China. Objectively, the environmental management in China still remains heavily dependent on the regulatory and legislative instruments. The enterprises tend to disobey the agreements without the sanction mechanism.

According to the past experience, the most effective sanction instrument in China is economic punishment. This sanctioning instrument could be used in future voluntary agreements. Economic punishment can have many forms. One example is a deposit-refund system, where the deposit is not refundable when the participants failed to reach the targets. Increasing carbon dioxide emission taxes is also seen as a kind of economic punishment and effectively used by many developed countries, but it seems impossible—at least under the present circumstances—to adopt this approach in China (China Energy Conservation Association, 2003).

4.2.5 Discussion and recommendations

First of all, I would like to refer back to the above mentioned criterion 6. Since the voluntary agreement intends to cover the iron and steel sector prior to other sectors, it can be anticipated that there are some problems to be faced in the near future. One of them is how to spread voluntary agreements into steel enterprises in those provinces with more production capacity but a relatively lower level of economic development.

Could they be allowed to use lower energy efficiency standards in order to make sure they can reach the targets with their financial ability? Obviously, the answer is no, because in that case these enterprises will still stay in a disadvantaged position in the fierce competition. In my opinion, the only solution to this problem is the improvement of supporting policies. The Government could prolong the period of supporting policies, depending on the specific energy-efficiency target and financial ability of the participant enterprises.

Secondly, after assessing the design process of the pilot project, we can see that the drawbacks of the pilot project concentrate on setting energy efficiency targets and establishing supporting policies. The energy efficiency improvement potentials which are evaluated by participant enterprises themselves, will result in lower targets compared to their real ability. While some of the supporting policies were defined prior to the development of the targets, other supporting policies were only advocated as possible policies to be provided by the central Government, which gives the enterprises no certainty regarding these possible policies and leads to a situation where relatively weak targets were set for 2005.

The problems that will probably be encountered in the future work still focus on these two important issues. Since this instrument is named “voluntary agreement”, it is supposed to provide more flexibility. Here I would like to put forward my suggestions regarding these two issues. According to the supporting policies used in the pilot project in China, these policies can be divided into five categories, namely: the national bonds discount, the developing funds for science & technology, the income tax policy, public recognition and international cooperation. These supporting policies are all the possible policies that the Chinese Government can offer to the participating enterprises under the current situation.

Normally, the supporting policies included in the voluntary agreements are decided by the Government, which leaves the participant enterprises with little room to choose. I suggest that after setting the energy efficiency targets, the participant enterprises could negotiate with the Government concerning the potential supporting policies. These policies will be based on the ambition of the energy-efficiency improvement targets, which means the higher the targets are, the more supporting policies; the lower the target, the fewer supporting policies.

In this way, the enterprises can have more flexible choice of the components of the supporting policies which are suitable for their own demands. Furthermore, they will try to set relatively higher targets in order to get more supporting policies from the Government.

4.2.6 Conclusion

After benchmarking the design process of the pilot project against the international standards, the following could be concluded. While the general concepts of negotiated agreements and of the value of energy-efficiency improvements in the industry were easily understood and accepted in the pilot project, several specific components of successful voluntary agreements from around the world were not immediately understood and ultimately not adopted. For the Chinese Government and Chinese industrial enterprises, there is still a long way to go towards the international advanced level.

In any case, the pilot project is one attempt of implementing innovative instruments for energy efficiency improvement and environmental protection in China. Regardless its success or failure, more innovative instruments should be introduced in China in order to improve the level of national environmental management and the competitive ability of Chinese enterprises.

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4.3 The first hydrogen economy? An analysis of the transition to a hydrogen economy in Iceland

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"I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable. I believe then that when the deposits of coal are exhausted, we shall heat and warm ourselves with water. Water will be the coal of the future."(Jules Vernes 1870, "The mysterious island")

4.3.1 Introduction

During the last decade it has become clear that, in order to maintain our current level of economic growth, an alternative energy source to fossil fuels must be found. As described by Jeremy Rifkin in his bestseller 'The Hydrogen Economy' (2002) the oil reserves of the world are subject of an increasing scarcity, their prices are expected to rise drastically and they are mostly imported from politically unstable regions. Above that, due to mainly CO₂ emissions, fossil fuels appeared to be highly polluting for the environment, causing severe damage to (a.o.) ecosystems and human as well as animal health.

Current research focuses on the use of hydrogen as an alternative, clean energy source. In different countries experiments have started to study the transition towards an economy based on hydrogen. Iceland is one of the front runners in this transition; it has even planned to fully transform into a hydrogen economy by 2050, as the first country in the world.

However, a transition towards a new energy source requires not only changes in technology, but implies much wider changes, in different societal domains like economy, policy and culture. To study such huge societal changes the multi-level approach on transitions is often used. Within this approach, a technological transition is considered as an interaction between developments at many different levels of a socio-technical system. This enables the researcher to involve developments and influences at the different societal domains.

In this paper, we examine the transition towards hydrogen as an energy source. Our research questions are as follows:

- To what extent can the multi-level approach on systems innovation be applied to the Icelandic experiment to convert to a hydrogen economy?
- Which barriers and opportunities for the transition to a hydrogen economy can be found in Iceland?
- To what extent is the Icelandic experiment valid for other countries?

To answer these questions, first we study the multi-level approach on technological transitions in Section 4.3.2. Here we deal with the concept of a technological transition, barriers for such a transition and strategic niche management. Following, in Section 4.3.3 we consider some technical aspects of the transition towards a hydrogen economy such as the production of hydrogen, the working of a fuel cell, and the storage of hydrogen. In Section 4.3.4 we present Iceland as a case study of a transition into a hydrogen economy.

In Section 4.3.5 we answer our research questions by discussing several topics related to Iceland's experiment. Finally, we present our conclusions.

4.3.2 Technological transition and strategic niche management

Technology is a major development factor of modern societies. The emergence and diffusion of new technology means not only innovation in the technical domain, but also wide changes in other societal domains such as economy, policy and culture. According to Loorbach and Rotmans (2005) a *technological transition* is a long-term process of change during which a society or a subsystem of society fundamentally changes. The authors distinguish between two types of transitions. Transitions can be evolutionary or goal oriented. While the outcomes of evolutionary transitions are not planned, the goal oriented transformation is a result of a vision of the desirable end state in the development process.

Transitions are unique in their nature and context. Nevertheless, they have also much in common (Wieczorek & Vellinga 2004). The common transition features can be summarised as follows:

- Transition represents a major but gradual and long-term change in the way societal functions are fulfilled.
- Transition is coupled with high-level socio-cultural and institutional changes that are the result of technological change.
- The transition process affects many actors.
- Transition is a result of the interplay of many factors and actors.

These four general features point out that transition analysis should encompass technological, socio-economic and institutional changes. Important for this analysis is also the context of the transition process. Wieczorek et al. (2004) stress the importance of incorporating the context into the transition analysis because there are big regional differences in the levels of economic development, in climate and topography, in cultural and political patterns.

In the last decade the new concept of *strategic transition management* was introduced as a result of a broad societal discourse on risks and burdens of an industrialised world. The necessity of de-linking between economic growth and environmental pressure led to the emergence of a new management strategy. As noted by Loorbach and Rotmans (2005), the basic steering philosophy underlying transition management is that of *anticipation and adaptation*, starting from a macro-vision on sustainability, building upon bottom-up (micro) initiatives, while in the meantime influencing the regime at the meso-level. The idea of transition management reflects the multi-level perspective on transition processes, which will be discussed below.

Multi-Level Approach

The multi-level approach focuses on socio-technical systems and their shift from one "dynamic equilibrium" to another. The term *socio-technical system* describes, on the one hand, the interplay between different social actors which develop, diffuse and use technology, and, on the other hand, the functionality of this technology in different societal domains, such as transportation, communication, housing etc. (Geels 2004).

According to this perspective, the emergence, development, and diffusion of technology are a result of many complex and dynamic processes. In general, a socio-technical system is very stable because of the high interdependence of its elements. The stability of existing systems is described in the literature as a path-dependence or lock-in (Jacobsson & Johnson 2000). Therefore, the transition to a new socio-technical system depends not only on the development of new sophisticated technology, but it also requires high investments in new infrastructure, new production lines, acquirement of new technical skills, development of new standards, as well as changes in preferences or behaviour of users.

Geels (2002, 2004) conceptualises a technological transition as a successful interaction between three levels of the socio-technical system. These levels are: the socio-technical landscape, socio-technical regimes and technological niches.

At the macro-level the technological transition depends on the *socio-technical landscape*, which consists of cultural, political and economical contexts at the national and international level. Very heterogeneous factors belong to this concept, such as oil prices, political coalitions, environmental problems, economic growth, or cultural values and societal norms. Landscapes cannot be changed at will because material environments, shared cultural beliefs, symbols and values are, in general, hard to deviate from. History shows, however, that landscapes do change, but they do it very slowly.

Less strict is the structure at the level of *socio-technical regimes*. This meso-level is based on different rules and routines of firms, financial organisations, users, policy makers, scientists, engineers and other social actors. Socio-technical regimes determine the every day practice and, through that, create stability. The innovation at this level is mostly incremental: it aims primarily at an improvement of existing technologies and products. Only if certain routines and rules become a mismatch, an opportunity window for the introduction of radically new technology occurs. At this stage the existence of *socio-technical niches* is crucial for radical technological innovation. In the multi-level approach niches are placed at the bottom level of the hierarchy. They present protected places, incubation rooms for novelties. According to Geels (2005) there are different ways to protect new ideas and technologies. Protection can occur within companies as strategic investments in research and development. Government can protect new technologies through subsidies. Another possibility is the implementation of real-life experiments in which many actors are involved, e.g. firms, users, suppliers, universities, local and national authorities etc. Niches are crucial for the process of innovation because they enable or even stimulate deviations from the rules of the existing regime.

Socio-technical niches are multifunctional. They create space for research and development, and protect novelties unless they can technically and economically compete with existing technologies on the market. Niches also enable learning processes about the use and possible improvements of new technology. Finally, they provide space for building new supporting social networks. But the emergence of niches is strongly influenced by existing regimes and landscape. Therefore, the relationship among the three levels can be understood as a nested hierarchy, meaning that regimes are embedded within landscapes and niches within regimes, as shown in Figure 4.1.

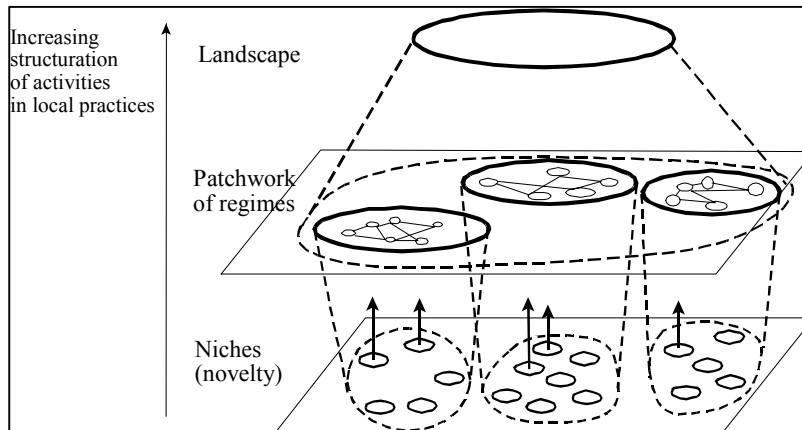


Figure 4.1 Multiple levels as a nested hierarchy (from Geels 2002: 11).

The shift from one regime to another is not easy because the existing regime is entrenched in many ways: institutionally, organisationally, economically and culturally (Geels 2005). Nevertheless, system innovations occur regularly as a result of the outbreak and following diffusion of new technologies in a society. The dynamics of the innovation process can be described in four phases (Geels 2005):

1. Novelties emerge in niches in the context of problems in the existing landscape and regime. Actors engage in experiments to work out the best design and find out user preferences.
2. The novelty is used in small market niches. Improvement of new technology is a goal on this stage. A learning process about the new technology takes place.
3. At this stage the wide diffusion of new technology and its competition with the established technologies take place. Internal and external circumstances at the regime level play an important role here. To these circumstances belong new technical problems, which cannot be met with the available technology; or problems, such as negative externalities, which require new or stricter regulations. Moreover, changes in user preferences (micro level), or landscape changes (macro level) can also put pressure on the existing regime. Besides, there are internal factors that stimulate diffusion of innovation, such as an improved cost/performance ratio of new technology, as well as an increased stability of new configurations because more elements are linked together. In this phase developments at multiple levels link together and reinforce each other, creating a new socio-technical regime.
4. Finally, the new technology replaces the old regime. This process is accompanied with changes in wider dimensions of the socio-technical regime. The emergence of a new regime may eventually also influence the wider landscape development.

Barriers to technological transition

As mentioned above the process of technological innovation refers to different levels and involves many actors. This complexity is coupled with many barriers and obstacles, which are shortly discussed here.

Kemp, Schot & Hoogma (1998) describe in their paper different barriers for the transition to a more sustainable transportation technology. In our opinion, this description of

barriers in the transportation sector can be applied to a discussion about transition processes in general. Different barriers can be mentioned in this context:

- Technological barriers. The new technology does not fit well into the existing system. It requires complementary technologies that might not be developed yet or are too costly. The technology itself can be ill developed in the early phases of the development process. It could also be too expensive because of the low scale production.
- Uncertainty about the market developments, about governmental policy and the regulatory framework. These uncertainties often lead to low investments in new technologies and new infrastructure.
- Cultural and psychological barriers. For many people the use of a specific technology, such as a car, is a status symbol. Many people are also inert because of the habit, and are for that reason sceptical about new alternatives.
- Economic barriers, such as uncertainties about consumer demands or the possible loss of market position of firms, in case of product failure.
- Lack of infrastructure and maintenance at the phase of diffusion of a new technology. Because there are not enough users, the building of the infrastructure is too costly, but at the same time, the lack of infrastructure breaks the diffusion of new technology.

Kemp et al. (1998) write in their conclusion: *“The restricted nature of socio-technical change is accounted for in large part by the embedding of existing technologies in broader technical systems, in production practices and routines, consumption patterns, engineering and management belief systems, and cultural values. This embedding creates economic, technological, cognitive and social barriers for new technologies.”*

The notion of technological regime helps to explain why most changes are of the non-radical type, aimed at regime optimisation rather than at regime transformation. To facilitate radical innovation, especially in relation to sustainable development, the idea of strategic niches management was introduced.

Strategic niche management

In a technological transition both the technology and the system, in which it is produced and used, change through a process of co-evolution and mutual adaptation. This is why many authors stress the crucial role of strategic niche management. Strategic niche management is based on the creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation (Kemp et al. 1998). The choice of niche policies needs to be based on the above mentioned barriers to the use and diffusion of new technologies. Many elements of an integrated and co-ordinated policy on strategic niche management are mentioned in the literature. The most important of them are:

- Formulation of long-term goals;
- Creation of an actor network;
- Co-ordination of actions and strategies;
- If needed use of taxes, standards, subsidies, public procurements.

According to Kemp et al. (1998), the challenge for governments is to ensure that the process of co-evolution of technological supply and demand leads to the desirable out-

comes. Jacobsson and Johnson (2000) conclude in their analysis of diffusion of renewable energies that the rate and direction of technical change is decided in competition between various technological systems, not only existing, but also fully developed and emerging ones. The way in which actors' competence changes, and institutions and networks are altered will shape the growth path of a new system and its ability to compete with other systems. The transformation process is, according to these authors, very open ended and can take many directions. In which direction the development turns, depends to a big extent on the activities of different social actors. In a recent publication on dynamics in socio-technical systems, Geels and Kemp (2005) make an important addition to the multi-level approach by stressing the crucial role of interactions between many social actors or groups. The authors write that the dynamics of transition are not mechanical or linear, but socially constructed. The linkage between processes at macro, meso and micro levels are made by social actors in their cognitions and activities. According to Geels and Kemp (2005), social actors "try to navigate the transition, they engage in commercial transactions, political negotiations, power struggles, coalition building, controversies, and debates". Beside the activities of social groups, another important factor can influence the direction of a transition. The direction of a transition depends on different technical aspects of a new technology, and on its ability to technically compete with already existing technologies and those still in development. Because the present paper deals with different aspects of possible transition to a hydrogen society, in the next section we focus on technical aspects of the hydrogen technology.

4.3.3 Technical Aspects of Hydrogen

The idea of using hydrogen as a power source is anything but new, as said at the beginning of this paper. Two British scientists already attempted the electrolysis of water in 1800, just after the electric cell was invented. Jules Verne spoke in his 1874 novel "The Mysterious Island" about 'water as a fuel for steamers and engines', after it was 'decomposed into its primitive elements by electricity'. Even though the author does not go into technical details, here it is necessary to take a closer look at the technical principles of an energy system based on hydrogen. The following technical principles of hydrogen will be discussed:

- methods to produce hydrogen;
- the working of a fuel cell;
- storage of hydrogen.

3.1 Hydrogen production

Hydrogen can be found all over the world -it is not a scarce article-, but it mostly exists in a bounded form, either bounded to water or fossil fuels, or in living organisms. This means that hydrogen is not directly available, but that it must be extracted from other matters in nature where it is found.

Natural Gas

At present almost half of the hydrogen produced worldwide, is derived from natural gas via a steam reforming process. In a catalyst the natural gas and steam react. In this process the hydrogen is made free from the hydrocarbons, and carbon dioxide is created as by-product. The carbon dioxide can be caught and stored underground.

Many specialists believe that in the future the main part of hydrogen will be produced by steam reforming of natural gas, because this is the cheapest source of energy (MacKenzie, 1994: 63; Rifkin 2002: 215).

Coal

Coal is another fossil fuel that can be used for the production of hydrogen. The method is based on coal gasification. This gasification process provides a synthetic gas that consists of hydrogen and carbon monoxide. The hydrogen is released by steam, and can be used for the generation of electricity in turbines and fuel cells, and in a combined use of both technologies. The hydrogen can also be used as fuel for refineries and for vehicles. The carbon dioxide can be stored underground in liquid form. This process, however, is more expensive than the production based on natural gas. Nevertheless, for countries with large coal reserves such as the United States, coal gasification could be an attractive source of hydrogen production.

Biomass

During the fermentation of biological waste, hydrogen and methane are produced. In nature, bacteria immediately use hydrogen and only methane remains. It is technically possible to prevent this process, so that hydrogen and methane can be produced separately. Then, next to the production of 'green' gas, it is possible to use the hydrogen in a fuel cell.

Electrolysis

Another way to produce hydrogen is through electrolysis. This method has the advantage that it does not need to use fossil fuels. Through electrolysis water is divided into hydrogen and oxygen atoms with the use of electricity. At present only 4 percent of all hydrogen is produced by electrolysis (Rifkin, 2002: 216). The reason is that electrolysis is more expensive than steam conversion of natural gas, because electrolysis itself needs electricity. This electricity could come from any available energy source.

According to Rifkin (2002), the central question regarding hydrogen production lies on: is it possible to generate electricity necessary for the electrolysis with the use of sustainable, carbon free energy, such as photo voltaic energy, wind or hydro power, or geothermal energy?

It seems obvious that the answer is affirmative, but that the next question is: against what costs? The approximate costs of producing hydrogen from various sources are shown in Table 4.4. The cheapest source is steam reforming of natural gas. From the renewable sources, electrolysis with electricity produced from biomass or from hydroelectric energy is the cheapest alternative.

Table 4.4 Production Costs of Hydrogen¹³¹.

Source	Hydrogen Cost (\$/Million Btu)	Cost of Equivalent Gasoline
Natural Gas	5-7	0.65-0.92
Coal	8	1.05
Hydroelectric (Electrolysis)	9-19	1.18-2.49
Wind (Electrolysis)	31	4.06
Solar Thermal (Electrolysis)	37-50	4.85-6.55
Solar PV (Electrolysis)	45-101	5.90-13.23
Biomass (Large Scale)	6-10	0.80-1.30

The main conclusion regarding the production of hydrogen through electrolysis is that the price gap between renewable sources and fossil fuels has to be bridged, in order to give a chance to hydrogen produced by electrolysis based on renewable sources.

Another positive side effect of the use of hydrogen is that it can neutralise the unreliability of sources depending on changing circumstances, such as wind, sun and hydro-power. The energy from such sources can be stored in hydrogen, and consequently make it available at the moment when the energy is needed. Even in case of a change in electricity use and a lack of wind or sun, such a hydrogen storage can prevent shortage.

Fuel cell technology

After extraction, hydrogen is pumped into a fuel cell in order to produce electricity. A fuel cell efficiently converts chemical energy into electricity. Actually, the opposite process of electrolysis takes place; hydrogen and oxygen are combined to produce electricity, water and waste heat. Unlike batteries fuel cells do not have to be recharged, but they produce electricity as long as the fuel is provided. The life span of a fuel cell itself or of its parts, such as the membrane, is the main restrictive factor. Fuel cells are named for their electrolyte. The most advanced fuel cells include phosphoric acid, molten carbonate, solid oxide, alkaline, and solid polymer, which is known as the proton exchange membrane (PEM) fuel cell.

According to some specialists such as the Dutch researcher Schimmel (Stromen, no. 3, 2005) the waste heat could be used to release the hydrogen. However, in that case the fuel cell must work at higher temperatures than what is now usual. The present (PEM) polymer fuel cells works at a temperature of maximally 100° C. There are also SOFC (solid oxide fuel cells) that operate at temperatures above 600° C. According to Schimmel, the temperature must be in the middle. A problem is that for temperatures above 200° C, special electrolytes are necessary that are still in a development phase. The working of a fuel cell at temperatures around 200° C is also attractive for other reasons. The electric conductivity is better and the risk of carbon monoxide intoxication is smaller. As storage material, grounded magnesium seems most suitable. This material can bind 6 % hydrogen, but in grounded form and by adding a catalyst the storage and discharge can happen faster. Also, compared to other materials such as lithium or sodium aluminium hydride, reloading is better with magnesium.

¹³¹ Based on Table 4.5. In MacKenzie (1994), *The Keys to The Car, Electric and Hydrogen Vehicles for the 21st Century*. Discount rate of 6 percent is assumed.

Storage methods

The storage of hydrogen is a major economic and technological barrier for its use in transportation applications. Hydrogen has the highest energy density of any common fuel, but it has one of the lowest densities per volume unit. Hydrogen can be stored in many forms: as a gas in high-pressure tanks, as a low-temperature liquid, as a powder in metal hydride tanks, absorbed to carbon at low temperatures, and in recyclable liquid chemical carriers. (MacKenzie, 1994: 70)

Common is the use of compressed hydrogen at a pressure of 350 atmosphere, as happens at the CUTE project in Amsterdam, but this demands much space. Furthermore, the acceptance of such high pressure tanks is expected to be difficult, because of the explosion risk of hydrogen. The storage at a very low temperature is both financial and energetically unattractive, among other things because of the inevitable losses of energy. The use of metal hydrides is another possibility, but this has the disadvantage that much heat is needed to free the hydrogen. (Stromen, Feb. 18, 2005, no. 3, p. 4).

It is possible to transport hydrogen through a pipeline, like natural gas. The possibilities to mix natural gas and hydrogen are researched; a mix of 6-10 percent hydrogen with natural gas is considered possible. In that case no new pipelines are necessary.

From niche to regime level?

Hydrogen has different faces; it can be derived from different energy sources, and it can produce different kinds of energy for various uses; household, electricity or transportation use. Current research and pilot experiments show that there are many technical possibilities and that a numerous activities are going on at technical universities, often in cooperation with companies. This surely means that hydrogen is a potentially new renewable energy source.

There are, however, still many (technical) barriers. An important barrier is safety and risk perception. The explosion danger of hydrogen asks for good solutions that are acceptable for the general public. Furthermore, the methods for storage and production of hydrogen must become more efficient. Not least, hydrogen needs to gain a better competitive position compared to (relatively cheap) fossil fuels. Only then, hydrogen could make the step from (present) niche level to regime level.

4.3.4 Iceland: the first hydrogen economy?

In 1978, B. Árnason, chemistry professor at the University of Iceland and also called 'Professor Hydrogen', wrote his first paper on the possible transition to a hydrogen-based energy production in Iceland. This first attempt was not met with enthusiasm in the scientific world. However, as environmental consciousness grew and as technological advances were made in the production, distribution and storage of hydrogen, the idea of Árnason gathered much more support. This resulted in the ambitious plan to develop the first hydrogen-based economy of the world in Iceland. In 1997 the Government of Iceland declared its aim for a hydrogen economy, supported by the Prime Minister, the Minister of Industry and the Minister of Environment. A research team at the University

of Iceland was started to study the prospects, and in 1998 the venture 'Icelandic New Energy' was established (Optimistmag)¹³².

In this section we explain the experiment of Iceland to convert to a hydrogen-based economy. It serves as a case study to explore the different barriers and stimuli that a transition to a hydrogen economy (could) encounter and what is required to achieve such a transition. First, the background and the goals of the experiment are explained. Then the achievements and encountered problems are shortly dealt with. Afterwards, the conditions that make Iceland a suitable country for such an experiment are described. Finally a conclusion is given. In the next section the posed questions are to what extent requirements for a transition are met in Iceland, what barriers exist and to what extent the transition fits in the multi-level approach of technological transitions.

The Icelandic experiment

The goals

In 2002, an experiment started in Iceland to transform into a hydrogen-based economy by 2050. The ultimate goal of the experiment is to meet all energy needs, which are currently satisfied by imported fossil fuels, with domestically produced hydrogen. The purpose is to break completely with the reliance on fossil fuels, which provides circa $\frac{1}{3}$ of the total energy needs of the country, as seen in Figure 4.2.

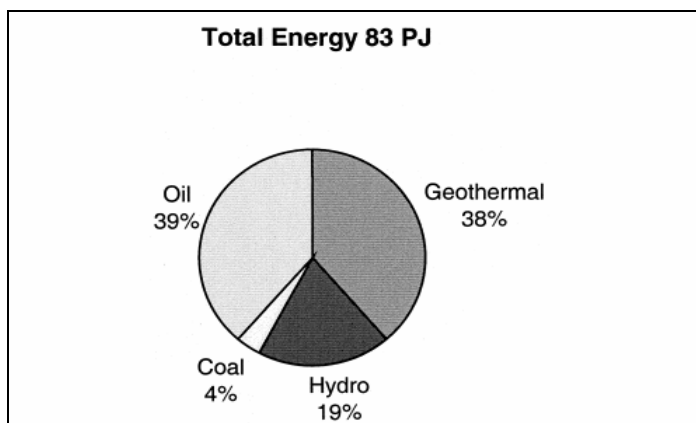


Figure 4.2 Types of energy sources used in Iceland (from Árnason and Sigfússon 2000: 390).

The transition from a socio-technical system based on the use of fossil fuels to a new socio-technical system, in which economy would be based on hydrogen use, embraces the following (minor) goals:

- to convert all city buses from gasoline-power to hydrogen-power;
- to convert all personal vehicles from gasoline-power to hydrogen-power;
- to convert the fishing ship-fleet (2,500 boats) to hydrogen-power.

These goals will be executed in 5 steps:

¹³² <http://www.optimistmag.org/gb/0003/article.php?id=297> (visited at 11-03-2005).

1. Proton Exchange Membrane (PEM) fuel cell bus demonstration project of 3 public transport busses in Reykjavík.
2. Gradual replacement of all city busses in Reykjavík and possibly other busses by PEM fuel cell busses.
3. Introduction of (methanol powered) PEM fuel cell cars for private transport.
4. PEM fuel cell boat demonstration project of 1 boat with stored hydrogen (bound in methanol).
5. Gradual replacement of the fishing fleet by PEM fuel cell powered boats (Árnason & Sigfússon 2000: 393)¹³³.

The first phase has already started, with the project called ECTOS (see also below). The city buses, manufactured by Daimler-Chrysler, have PEM -fuel cells, powered by hydrogen in methanol, at 300 bar (for more technical details see Section 4.3.3). The total costs of this project are 6.7 million Euro, which are paid by EU subsidies (2.8 million Euro) and the shareholders (see below). A bus costs about 1.25 million Euro, which is 3 to 4 times as much as a bus driving on fossil fuels.

Achievements and further plans of the experiment

The experiment already has some achievements. In 2003, the first hydrogen fuelling station came into use. In the same year, three city busses on hydrogen were introduced in Reykjavík and take now part in the public transport system of the city. The project serves as a demonstration for the conversion of all city buses in Reykjavík to hydrogen, which will start after finishing the project. In 2004, another project called 'New-H-Ship' has started. It investigates hydrogen applications in the marine sector (Sigfússon 2004: 3). In 2006 a demonstration project for a fuel-cell powered ocean ship is planned. Besides this, in co-operation with Hamburg Electricitäts Werke, a project called 'Euro-Hyport' is started. Its goal is to explore the possibilities for hydrogen transport from Iceland to Europe (Sigfússon 2003b: 8).

The experiment has already stimulated many other countries in the world for the transition to a hydrogen economy. In 9 European cities¹³⁴ a project similar to ECTOS, called CUTE (Clean Urban Transport for Europe) has started, which also tests the use of 3 hydrogen city buses. These experiments represent the activities at niche level. Because the use of hydrogen technology is very expensive, and, at the same time, the technology itself requires further improvements, it has not been used outside the niches yet. Learning about hydrogen, as well as the improvement in its technical and economic characteristics, would enable the diffusion of this technology in the future.

Benefits for Iceland

There are several reasons why Iceland has started this ambitious experiment. Firstly, most of the currently imported fossil fuels are used in the fisheries industry, the biggest industry of the country. Consequently, the profitability of this industry, and thus the en-

¹³³ Árnason and Sigfússon 2000, 393; www.hydrogenus.com/advocate/ad52icel.htm (visited at 10-03-2005)

¹³⁴ i.e. London, Luxemburg, Porto, Madrid, Barcelona, Stuttgart, Amsterdam, Hamburg, Stockholm, and also Perth (www.optimistmag.org/gb/0003/article.php?id=297, visited at 11-03-2005)

tire Icelandic economy, is linked to the price of oil. Because oil is relatively expensive and it is imported from politically unstable regions, Iceland is in a very reliant and vulnerable position (Fuelcell Today)¹³⁵. By converting to a hydrogen-based economy, Iceland will stop being dependent on imported fossil fuels. Furthermore, it is realised that eventually fossil fuels will run out, so an alternative must be found in any case.

Secondly, conversion towards a hydrogen economy could strongly reduce Iceland's Greenhouse Gas (GHG) emissions¹³⁶. Currently, Iceland has large CO₂ emissions from trucks and fishing boats and from the metal production industry. The country is even one of the biggest GHG emitters per capita in the world¹³⁷, which also caused problems when signing the Kyoto Protocol. A decrease of these emissions would imply a better compliance with international agreements.

Thirdly, by executing this experiment, Iceland puts itself at the forefront of a potentially huge technological, environmental and economical breakthrough, which will bring domestic advantages and international rewards. Additionally, the huge potential for hydrogen production enables excellent export possibilities for Iceland on the new international energy market¹³⁸, which represents a strong economic incentive. Finally, it is realised that Iceland is very suitable for executing this experiment (see 'conditions of Iceland').

All these reasons, with the exception of specific conditions of Iceland itself, can be related to the macro dynamics, which take place at the landscape level. Increased instability and uncertainty associated with the oil import, high oil prices, and the need to reduce CO₂ emissions lead to more pressure on the current socio-technical regime from the landscape in Iceland. Another important factor is the anticipation of a potentially advanced economic position for Iceland in the future. Different social actors and groups at the regime level promote the latter. These social actors and groups build networks and partnerships. Their aim is to support the transition process by enabling the breakout of hydrogen technology from the niches into a broader societal context.

Social actors involved in the experiment

The experiment has attracted many sponsors and partners who take part in the joint venture 'Icelandic New Energy Ltd.', which has the goal to "investigate the potential for eventually replacing the use of fossil fuels in Iceland with hydrogen and create the world's first hydrogen economy"¹³⁹. One of the first projects of this venture is ECTOS (Ecological City Transport System), which aims at developing the infrastructure and expertise needed for hydrogen-powered public transport. This project is an excellent example of supporting the development of a new technology at niche level.

¹³⁵ www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

¹³⁶ www.news.bbc.co.uk/1/hi/programmes/newsnight/archive/2208013.stm (visited at 09-03-2005).

¹³⁷ www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

¹³⁸ www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

¹³⁹ www.newenergy.is/ (visited at 09-03-2005).

Businesses and organisations take part in this project because they recognise Iceland has many characteristics that make it an ideal testing ground for the transition to hydrogen¹⁴⁰. They realise that once fossil fuels have come to an end, a new energy market will emerge, and they all want to profit from dominating that market. Besides, many businesses and organisations want to strengthen their status as environmentally friendly or conscious business, by subscribing to the Icelandic experiment. Common interests lead, in our case, to the emergence of networks and partnerships between different private and public companies. One example of such a partnership is 'Icelandic New Energy', whose main shareholder is the Icelandic holding company Vistorka H.F.¹⁴¹.

Besides, the venture has several public partners, which are the Government of Iceland, the Reykjavik Municipal Power Company, the University of Iceland, the Icelandic Technological Institute, and the European Commission. Also the New Business Venture Fund, the Fertiliser Plant, and the Reykjanes Geothermal Power Plant are participating in the venture (Árnason & Sigfússon 2000: 393). As may be clear from this, the experiment has achieved much support, nationally as well as internationally, from the private sector as well as from the Government.

Specific conditions of Iceland

Several conditions make Iceland very suitable to shift to a hydrogen economy. Historical developments, the country's geological and geographical conditions, as well as some social aspects facilitate, in our opinion, the transition process in Iceland. Besides, several structural conditions bring about strong incentives for the transition to hydrogen. These supporting conditions are described below.

Historical developments

In the 20th century, Iceland has undergone two major energy revolutions that provided the country with some experience in changing energy sources:

- From the beginning of the 20th century, hydroelectric resources instead of gasoline are used to produce electricity.
- From the 1940's to 1975 gasoline was replaced by the use of geothermal water supplies for the heating of all houses in Reykjavik (i.e. 90% of the country's houses), and to supply 10% of the country's electricity needs.

As a result, only $\frac{1}{3}$ (38%) of the used energy in Iceland is produced by fossil fuels¹⁴². Moreover, hydrogen has been produced in Iceland already for more than 50 years to be used in fertilisers. Consequently, the technique of producing hydrogen is well known already to the energy industry (Sigfússon 2003a: 64).

¹⁴⁰ www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

¹⁴¹ Other shareholders are: Shell Hydrogen, that provides the hydrogen-fuelling facilities; Norsk Hydro (Norwegian hydroelectric company), that supplies electrolyzers to produce hydrogen; and Daimler-Chrysler (car manufacturer), that develops and supplies the fuel cell based vehicles (cars, busses), in co-operation with Ballard Power Systems.

¹⁴² www.h2net.org.uk/PDFs/RN_1/Iceland_presentation.pdf (visited at 10-03-2005).

Geological conditions

Iceland consists mainly of an arctic desert, including mountains, glaciers and volcanoes. It is a geologically young landmass (ca. 2 million years old), located on the mid-Atlantic ridge. This causes a high level of volcanic activity (as a result of the moving North-American and Eurasian continental plates), and the presence of much hot springs and geysers¹⁴³.

Iceland possesses no domestic fossil fuels, except for some peat and birch wood¹⁴⁴. However, because of the geological activity, Iceland is rich in natural energy sources. Hydroelectric resources exist in the form of glacial rivers and waterfalls and many geothermal resources are present as underground hot water springs (240 °C). These resources have a very high potential; Iceland possesses 30 TWh/year hydro energy, of which only 15% has been used, and 200 TWh/year geothermal energy, of which only 1% has been used so far (Árnason & Sigfússon 2000: 389). On top of that, even if all vehicles and boats of Iceland were hydrogen-powered, only 10% of the available renewable energy would be used. This brings along a big potential for hydrogen export¹⁴⁵.

Geographical conditions

Iceland has a relatively small population of 290,000 inhabitants. This population is mostly concentrated in and around Reykjavík, the capital city. For the rest, the country is quite a small and isolated island (130,000 km²), which means that the energy network is separated from foreign influences¹⁴⁶. These characteristics require less complex management systems for energy production.

Following from its small size and population Iceland has a relatively small transport system, which can function as a basis for planning and monitoring experiments. The small size also implies that small projects have relatively big impacts; for example the three converted buses comprise 4% of the total bus fleet¹⁴⁷. Additionally, the transport system and infrastructure are comparable to those of other industrialised countries, which makes it easy for other countries to adopt the results of the experiment¹⁴⁸. Finally, the small, self-contained communities are very suitable for implementation of innovations. All these characteristics enable and facilitate the real life experiments with the use and improvements of hydrogen technology at the niche level.

¹⁴³ www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

¹⁴⁴ <http://www.optimistmag.org/gb/0003/article.php?id=297> (visited at 11-03-2005).

¹⁴⁵ www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

¹⁴⁶ www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

¹⁴⁷ Thorsteinn Sigfússon, I., IPHE Country Paper: Iceland. ILO-011-04. From : www.usea.org/IPHE/country%20papers/Country%20paper%20Iceland.doc

¹⁴⁸ www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

Social aspects

In general, Icelandic people like to see themselves as innovative people¹⁴⁹, living in a “clean” country. They are very environmentally conscious, and highly supportive to environmental programs, as is shown by successful recycling programs. The Icelandic people like to be independent, including in their energy provision¹⁵⁰. As a consequence, they are very committed to the hydrogen experiment; about 93% of the people are positive about the idea of replacing fossil fuels by hydrogen¹⁵¹. This has led the Government to make it part of its official policy (Sigfússon 2003a: 62). A population receptive to new ideas and technology and the full backing of the Icelandic Government have strongly supported the rise of the experiment¹⁵².

Also important to note is that the biggest users of fossil fuels, the fishermen, are very willing to transfer to another fuel. They don’t like oil, because it is expensive, it stinks and it “makes everything dirty”¹⁵³. Strong environmental awareness of the people and a positive attitude towards hydrogen use instead of fossil fuels, make it easier for the Government to implement a policy related to the introduction of hydrogen technology.

Structural conditions

The absence of a domestic fossil fuel industry in Iceland prevents lobbying from interest groups against a hydrogen fuel based economy. However, the country’s biggest industry, the fisheries, is still fully dependent on fossil fuels, next to transport and the metal industry (mainly aluminium smelting). Especially the fishing industry emits large amounts of CO₂; roughly 720,000 tonnes/year, which means that every ton of caught fish equals ca. ½ ton of CO₂ emitted (Sigfússon 2003b: 9). Next to the fact that these emissions hindered Iceland to sign the Kyoto Protocol and they still trouble the country in complying with international agreements on emissions, this is a politically as well as economically vulnerable position.

Iceland has also the highest car ownership per capita in the world; over 180,000 cars are present in the country (Sigfússon 2003a, 62-63). And above that, Iceland is probably one of the largest producers (and users) of electricity per capita in the world (Sigfússon 2003b:1).

The use of hydrogen as a fuel will lower CO₂ emissions ((Sigfússon 2003a: 63-64); use of hydrogen in transport could reduce the GHG-emissions by 33%, and if also the fishing fleet is converted to hydrogen, the emissions can even be reduced by 66%¹⁵⁴. And, of course, hydrogen-based energy will make Iceland independent from politically unstable regions.

In summary, we can say that there are many factors at the landscape, regime and niche level, which stimulate the transition process in Iceland. Different dynamics at the land-

¹⁴⁹ <http://news.bbc.co.uk/1/hi/programmes/newsnight/archive/2208013.stm>

¹⁵⁰ <http://news.bbc.co.uk/1/hi/sci/tech/1727312.stm>

¹⁵¹ www.ambitalia.no/science/publications_norway/pdf/Hydrogen_Iceland.pdf

¹⁵² www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/Legislation/DisplayLegislation/0,1768,365,00.html (visited at 10-03-2005).

¹⁵³ <http://news.bbc.co.uk/1/hi/programmes/newsnight/archive/2208013.stm>

¹⁵⁴ www.hydrogenus.com/advocate/ad52icel.htm (visited at 10-03-2005).

scape level such as international agreements concerning the reduction of GHG emissions, the increased instability and uncertainty connected with the oil import, and some other factors exert an increased pressure on the current fossil fuel based socio-technical regime. At the same time, many initiatives took place in the niches. Big national and international networks were created. Besides, the Government of Iceland plays a leading role in the initiation of niche experiments, and thereby facilitates the transition to a hydrogen society.

One important feature of the Icelandic transition is, in our opinion, its weaker path dependence. If this is true, it would mean that Iceland is more suitable for the transition than other countries are. By saying this, we do not mean that there are no barriers on Iceland's way to a hydrogen economy. Because the technological transition process embraces all societal domains, it is not surprising that we found many obstacles, which slow down and render more difficult the transition in Iceland.

Barriers

During the experiment, several barriers are encountered that hamper or slow down the transition process.

Technical and structural barriers

Capacity problems are very challenging to the experiment. The current hydrogen production (see 'historical conditions') is only about 2,000 tons/yr, while 80 to 90,000 tons/yr are needed for a fully replacement of fossil fuels by hydrogen¹⁵⁵. The current method to produce hydrogen, electrolysis by internal combustion engines, is not that energy efficient: it is three times as expensive in energy use as current fossil fuel imports. However, according to Árnason and Sigfússon (2000: 390), PEM-fuel cells (which Iceland is planning to use) are up to three times as efficient as combustion engines, which will make hydrogen fuel competitively priced.

Several storage problems are also present. Concerns about the safety of storing hydrogen are fostered by the Hindenburg accident¹⁵⁶. But more important are the concerns about size and form of the stored hydrogen. Hydrogen can be stored in a gaseous or in a liquefied state, or bound in metal hydrides (e.g. magnesium) or liquid hydrides (e.g. methanol)¹⁵⁷. Gaseous hydrogen is more energy efficient, but difficult (unsafe) to handle and store, while liquefied hydrogen is more suitable for mass consumption, but requires very much storage space. Especially storage of hydrogen on ships is problematic and requires more scientific research (Sigfússon 2003a: 65).

¹⁵⁵ www.hydrogenus.com/advocate/ad52icel.htm (visited at 10-03-2005)

¹⁵⁶ In 1937 the commercial zeppelin 'Hindenburg' burned down due to a hydrogen fire that killed many people. However, discussion exists on the role of hydrogen on this accident; some state that hydrogen did not cause the fire, but only fuelled it. Besides, hydrogen was not the fuel of the zeppelin (Sources: www.nlhs.com/tragedy.htm and www.emagazine.com, visited at 09-03-2005).

¹⁵⁷ www.optimistmag.org/gb/0003/article.php?id=297 (visited at 11-03-2005).

A lack of infrastructure also hampers the transition. Especially the implementation of hydrogen based private transport requires well-developed infrastructure and technical support, neither of which are present yet.

Economic barriers

The price of hydrogen-fuelled transport or industries is still many times higher than fossil fuel based ones. This seriously hampers the development of needed technologies. However, during the process an increased hydrogen production will lead to lower prices, because of the emergence of an economy of scale. Also, the Icelandic Government is planning economic incentives for zero-emission vehicles by means of exclusion of road taxes (Sigfússon 2003a: 65).

Besides, some cost-problems are linked to the hydrogen storage problem, as described above. The production of liquid hydrogen is two times as expensive as the production of gaseous hydrogen¹⁵⁸, because of the energy needed. As shown above, some structural obstacles as well as economic barriers must be overcome to reach a successful transition in Iceland.

Conclusion

The increasing threat of being dependent on fossil fuels, caused by rising prices and an increasing scarcity, have led Iceland to start the very ambitious experiment to transfer to an economy based on hydrogen instead of fossil fuels. Because fossil fuels entail only $\frac{1}{3}$ of the energy need, this seems to be a realistic goal. The remaining $\frac{2}{3}$ of the energy need is based on hydropower and geothermal energy sources, both clean and renewable.

Historical developments, geological and geographical conditions and also some structural conditions facilitate the transition. Besides, the social acceptance of the transition is very high and also the Government strongly supports the transition by means of research and development, subsidies and other economic incentives as well as the initiation of real life experiments. However, also some structural and economic barriers exist, that hamper the developments.

4.3.5 Discussion

In this section, we will discuss the research questions. The *first question* was to what extent the multi-level approach on system innovation could be applied to the Icelandic experiment to convert to a hydrogen economy. The transition in Iceland meets all the general features of a technological transition; it is about socio-technical, economic as well as about institutional changes. Obviously the transition in Iceland is *goal oriented*: the outcome of the transition is fixed and planned as a result of a certain vision, which is the total replacement of imported fossil fuels by domestically produced hydrogen.

The multi-level approach focuses at shifts from one dynamic equilibrium to another within socio-technical systems. The emergence, development and diffusion of technology is considered as the result of a co-evolution of many complex and dynamic processes (see Section 4.3.2). In Iceland, we can observe such processes leading to a new dy-

¹⁵⁸ www.optimistmag.org/gb/0003/article.php?id=297 (visited at 11-03-2005).

namic equilibrium indeed. These processes are the result of a co-evolution of processes at different levels, but the main impulse for the Icelandic experiment came from the Government, motivated by developments at the landscape level.

According to the multi-level approach, a transition is a successful interaction between developments at the landscape, regime and niche levels of a socio-technical system. In Iceland's experiment, indeed several events or changes have occurred at these different levels. At the landscape level, oil prices, environmental problems and increased international pressure to comply with the Kyoto Protocol arose, leading to the (political, economical as well as cultural) need for alternatives to replace oil. At the regime level, the Government declared its interest in the transition and started to develop policies to encourage it. Also the niche level can be recognised in the Icelandic experiment; the transition has started with the implementation of small-scale projects in niches (the communities), to test technological performance and social response. This niche implementation is executed as a result of Government policy, and therefore the transition was initiated at regime level before it was implemented at niche level. This corresponds to other case studies on goal-oriented transitions described by Geels and Kemp (2005).

To answer our first research question, we can say that the multi-level approach is useful for analysing the Icelandic experiment to the extent that it reflects the observed complexity of the interactions between the levels and social actors of the technological transition.

Our *second question* was which barriers and opportunities for the transition to a hydrogen economy could be found in Iceland. Several conditions are present in this country, which have a positive impact on the emergence and the speed of the transition towards a hydrogen economy. The *geological and geographical* conditions of Iceland have a very positive effect on the transition. Many renewable resources are available or are relatively easy to produce in an environmentally clean way. New technologies can be tested under severe weather conditions, seasonal change and a varied topography. Besides, small-scale projects are easy to implement at niche level in Iceland. At the same time, these projects have a relatively big impact on society due to the small size of the country and its population.

Also the *social and political conditions* in Iceland strongly support the transition; both the Government and the public recognise that a dependence on external energy sources causes considerable economic, social, ecological risks to modern society (Fernandez 2005, 240). Hence, there is political will, as well as strong social support for the transition to a hydrogen economy. Besides, there is no lobbying pressure from interest groups to stick to fossil fuels, because no domestic fossil fuel industry exists.

Finally, also some *historical developments* encourage and facilitate the transition. There is technological experience with both transitions towards renewable energy sources and hydrogen production. The latter has been used for a long time and, therefore, is partially incorporated in the existing regime.

Next to the opportunities, we also found barriers to the transition towards a hydrogen economy. Several of these barriers are described in Section 4.3.3. While technological and economic barriers, as well as a lack of infrastructure play an important role in the Icelandic experiment, other common obstacles such as uncertainty about governmental regulations, or problems with social acceptance of new technology could not be found in

Iceland. Technological barriers are the results of the lock-in or path dependency of the existing regime. In the case of Iceland these barriers are less influential than in other countries because of the historical as well as geographical and geological conditions that facilitate the use of renewable energy and hydrogen. Nevertheless, complementary technologies are necessary for a further transition to a hydrogen society, especially for the use of hydrogen in private transport. Some of these technologies are not yet (or not enough) developed. Besides, their use is still far too expensive, and, hence, they cannot yet compete with existing technologies based on fossil fuels.

Another problem related to the use of a new technology is the *lack of infrastructure*, which can slow down the implementation of new technological systems. This might also happen in Iceland, where only infrastructure for the current project is present. The first stages of a transition are like a “chicken-and-egg” situation; consumer demand won’t rise until the infrastructure is in place, which, in turn, won’t come about if no customer demand exists. Consequently, markets must be stimulated by Government, and that happens in Iceland. The Government has a clear standpoint in encouraging the transition and is developing policies and regulations that underline this. Because of the clear Governmental goals, such as to realise the transition by 2050, there is no big uncertainty in Government policy and regulatory frameworks. This stimulates investments within and from outside the country.

Another important factor is the broad acceptance of the use of hydrogen by the local people. There is no scepticism about the new technology under the residents. However, this positive attitude towards hydrogen does not automatically mean that people would quickly change their habits, especially in relation to the use of private cars. We expect that only if the hydrogen car can compete with a fossil fuel car in all its characteristics, the transition in mobility behaviour of people can occur.

Hence, our second question, which barriers and opportunities for the transition to a hydrogen economy could be found in Iceland, can be answered as follows. In Iceland the technological lock-in exists, but it is limited. Some general structural and economic problems of hydrogen, like production, capacity and storage, or the lack of infrastructure, as well as economic barriers like high prices and the absence of an economy of scale, hamper the developments in Iceland just as they do in the rest of the world. On the other hand, some specific Icelandic conditions positively affect the transition process. The geological and geographical conditions, several historical developments, and the social context all positively influence the transition towards a hydrogen economy.

The *third question* was to what extent the Icelandic experiment is valid for other countries. This mainly refers to the specific conditions of Iceland that were discussed before. Iceland consists of many renewable energy sources that are not present (at that level) in the rest of the world. A high altitude (just south of the Arctic Circle), the geographic location (North Atlantic lows) and the presence of icecaps provide many opportunities to produce hydropower. The volcanic nature of the island gives much potential for geothermal energy. Other countries will (initially) depend on fossil fuels to produce hydrogen, because most of them can not make use of such renewable resources as those in Iceland. Consequently, more technological advancements will be needed in other countries to transfer to a hydrogen-based economy. It will show more serious technical and economical lock-in problems.

Because of its historical developments, Iceland is already well under way; $\frac{2}{3}$ of its energy production is already based on renewable sources. Thus for Iceland, the transition to an economy completely based on renewable resources is much less rigorous than it would be for other countries, that do not have such a starting point. Also the size of the country and the population facilitates the transition process. The strikingly high level of social acceptance, the high environmental consciousness of the people and the leading role of the Icelandic Government also strongly support the transition. Finally, the absence of lobbying interests against a hydrogen economy is also supportive to the transition.

To summarise, we can say that the Icelandic experiment is valid for other countries, but to a limited extent only. Many facilitating conditions for the transition that are present in Iceland cannot be found in other countries. Also less strong path dependence on fossil fuels makes the transition for Iceland easier than it is for other countries. Besides, the fact that the transition is high on the agenda of the Government strongly facilitates the process. However, in most other countries no such vision exists at the regime level.

4.3.6 Conclusion

There are several ways in which hydrogen can be produced. Countries can extract hydrogen by using traditional energy resources or by using renewable energy sources. It appears, for example, that the USA had set its sights on advancing a hydrogen future without moving beyond a fossil fuel past. On the contrary, the European Union follows another strategy: it encourages the development of renewable technologies and aims to phase out its reliance on fossil fuels (Rifkin 2002). The European policy is a result of the commitment to the targets set out in the Kyoto Protocol on global climate change. The use of renewable energy sources for the extraction of hydrogen leads to substantial reduction or even elimination of CO₂ emissions, and, therefore, to more sustainability. Hence only the transition to a hydrogen economy based on renewable energy sources, and not on fossil fuels, is desirable from an environmental perspective. However, this option is still more expensive than the production of hydrogen by using fossil fuels. Therefore, more investments in research and development on the field of renewable technologies are required.

We also think that governmental subsidies are necessary to support the introduction and diffusion of these emission-free technologies. This economic instrument would help to overcome the huge path dependence of fossil fuels. Our case study shows that Iceland has an advanced position owing to its low path dependence. For other countries, however, the socio-technological lock-in in fossil fuels will be a much bigger problem on the way to a transition to a hydrogen economy, especially to an emission-free hydrogen production. In this respect one of the most important factors is the price of fossil fuels. If the currently high prices of fossil fuels on the world markets will not drop down, but stabilise or even increase, this would certainly stimulate the development and use of alternative energy sources. In this situation the chance that other countries develop a vision similar to Iceland is not small.

4.3.7 References

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