Summary

Environmental Sustainability Index (ESI) is a project conducted in 2000, 2001, 2002 and 2005 by Yale University, Columbia University and the world Economic forum with the aim of analytically driven approach to environmental decision making. ESI consists of 68 indicators and each indicator then has associated with a number of variables that are empirically measured involving the environmental sustainability factors.

In the project, 2002 Environmental sustainability index results in the Nordic context with the careful focus on Denmark are studied. Finland, Norway and Sweden score the highest ranks in 2002 Environmental Sustainability Index while Denmark can only be observed on the 31st rank. ESI measures overall progress toward environmental sustainability for 142 countries. This result is interesting concerning Denmark because all Nordic countries are culturally, politically, geographically, and historically are seen as very similar to each other. There should be an explanation for this lagging behind. In the project the reasons for this result is analyzed by examining each indicator in the Danish context.

PREFACE

My interest in sustainability had started with United Nations Conference on Human Settlements (Habitat II) in Istanbul, Turkey in 1996.There I worked as an interpreter (French-English- Turkish) for United Nations secretary. During this period, I became more conscious about environmental issues. Translating those assessments, statements, declarations and reports as well as encountering with international representatives from all levels opened my eyes more to this new way of thinking. At that time, I was studying molecular biology in Bosporus University, in Istanbul, then after a year I changed my area of degree and I got my B.S in biology with the concentration on environmental sciences from Marymount University, in Virginia. I further got my M.A in Environmental & resources policy from George Washington University in Washington DC.

In 1997, I attended to a Lions youth exchange program in Aarhus, DK. There I had a chance to encounter with Danish culture and Scandinavian ways of thinking. It was simple but functional, and it was respectful towards nature meaning that there is respect and caring for nature by humans. At least, in the camp those were the reflections that I had. I was impressed. Then in 2002, I married a Dane, and in 2004 we got our first son. In 2003, I started my masters in environmental management in Aalborg University. In 2004, in one of Andrew Jamison's lectures, I gave a short presentation on Habitat II and Turkish environmentalism. With the inspiring questions of my professor, the seeds of my future thesis had been sewn. The basic thoughts of my thesis project began to take shape in my mind. I was privileged to work with Andrew Jamison as my supervisor, with his challenging questions and encouragement it became possible to write this project.

FOREWORD

The project is made in the period 13 rd of November 2005 to 23 rd of May 2005 by Melis Andersen at the 9th and 10th semester of the study program in Environmental Management, Aalborg University, Department of Development and Planning. The theme of the semester is Master Thesis. The expected audience is mainly fellow students, the external examinator, supervisors. The references in the project are done by Harvard method and they are placed in (reference), and can then be found in the reference list in the back of the project.

The title of the project is Environmental Sustainability in Nordic Countries:
A Case study of Denmark. In the project Environmental sustainability Index is used as a tool to figure out the reasons for Danish lower score in this index compared to other Nordic countries. The project consists of eight chapters.

The figures and tables are enumerated continuously in each chapter, so that figure 1.1 refers to figure 1 in chapter 1.

Appendices A-I are placed in the back of the project. Appendix A explains each of the appendix and the data which they are founded on, including the sources of data.

Melis Andersen

CHAPTER1
INTRODUCTION

In the project, 2002 Environmental sustainability index results in the Nordic context with the careful focus on Denmark will be studied. The Nordic countries are usually considered as a homogenous cultural region with safe, clean, sustainable environment**.** Finland, Norway and Sweden scores the highest ranks in Environmental Sustainability Index as expected. On the other hand, Denmark can only be observed on the 31st rank. (The ranking table with all the countries can be seen in the appendix B) The Environmental Sustainability Index (ESI) measures overall progress toward environmental sustainability for 142 countries. In the construction of the ESI, all indicator scores are calculated in relative terms and then averaged to generate the composite scores. This assumes that the countries are fundamentally comparable. ESI allows cross-national comparisons of environmental progress by means of its building blocks *the indicators*.

ESI is a project conducted in 2000, 2001, 2002 and 2005 by Yale University, Columbia University and the world Economic forum with the aim of analytically driven approach to environmental decision making. ESI consists of five main components, 68 indicators. Each indicator then has associated with a number of variables that are empirically measured.

In ESI 2001, Denmark can be observed on the tenth rank while in ESI 2002, Denmark scores much lower, **Denmark can only be observed on the 31st rank** while the other Nordic countries (Finland, Norway, and Sweden) are scoring the highest ranks in both of the indexes. (The ranking tables 2001 and 2002 with the countries can be seen in the appendix B)This result is interesting because all Nordic countries are culturally, politically, geographically, and historically are seen as very similar to each other. There should be an explanation for this lagging behind.

There can be many reasons for this sudden drop of Denmark in the ranking of ESI. The change in selected indicators in the index, the governance, population density, changes in climate, environmental disasters etc. One of my focuses in this project will be on governance because my hypothesis is that governance is a major factor that shapes environmental sustainability.

Environmental sustainability is a process that requires focused attention on the part of governments, the private sector, communities and individual citizens. The institutional capacities of the political and administrative system, in combination with the prevailing national political style, may be enough to be able to make a nation environmentally sustainable. (Esty, 2000 p: 4)

In 2001, ruling social democratic party for the last 50 years in Denmark had to leave its power to liberal Venstre party. This political shift ended a period of decision making by means of multifaceted processes of participation. Before, the decisions were based on negotiation and compromise between the left/right wing. After the change, decision making is reduced to a rather straightforward effort to satisfy the voters who support the current government and brought into power.
(Jamison& Møhl, 2004) p: 27

The main focus of the new government changed from social and environmental performance to financial performance and this is observed by cancellation of several large wind-energy projects, closing down of innovative programs in environmental research evaluations.
(Jamison&Møhl, 2004) p: 27

This drastic change in Danish score can be the cause of this political regime shift. But since environmental issues are multifaceted and interrelated with other disciplines especially when it comes to sustainability there should be other areas to look in to find out the grounds for this drop.

Another focus in the project, other than the political shift will be the deep analysis of Danish indicator values that are having values very different from other Nordic countries.

"As in the original strategy, a key principle governing Nordic cooperation for sustainable development is – in certain areas – the 'highest level of ambition applied': if the Nordic country with the highest level of ambition is allowed to take the lead Nordic cooperation can be used as a lever, nationally and internationally. "

Nordisk Ministerråd, København 2004

Analyzing those values can provide a good explanation for Denmark's sudden fall as well as it can provide possibilities for making Denmark a more sustainable country and a leader in Nordic cooperation for sustainable development. One country can learn from another country's success, even if that does not mean that one should copy policies indiscriminately. Nordic countries have different strengths and weaknesses.

The availability of such a framework (ESI) can enhance the capabilities of state and local government and the private sector to address sustainability issues.

There are noted some parallels in the development of environmental policy in Nordic countries. The EU/EEA membership has made the Nordic countries more similar as regards laws and regulations. However there still continue to be important differences as regards to institutional structures.
(Koch, 2004)

There are great differences between the Nordic countries as regards to organisational and political structures and solutions. This is partly for historical reasons. When trying to solve coordination problems, the authorities face different institutional structures, which again lead to new variations
(Koch, 2004)

This difference can be related to their national differences in political and administrative structure. And this difference can be the turning point for Denmark's performance in ESI.

In the previous paragraphs, it had been demonstrated that after the political regime shift, ESI ranking of Denmark has dropped. At the same time, Denmark had never been considered as competitive with other Nordic countries when it comes to ESI. In the light of that I decided to formulate following problems to analyze.

- ***Is the political regime shift and change in environmental politics the reason for Denmark's dropping rank in ESI?***
- ***Why is Denmark not placed with the other Nordic countries in ESI? Why is it scoring much lower than its counterparts?***
- ***What factors can help us to understand Danish ranking in ESI?***
- ***What is special about Denmark compared to other Nordic countries***

1.1. Research design

In order to find an explanation for Danish scoring in ESI, following research design will be followed.

The report will be organised in seven main chapters and a concluding section. The first three chapters will be descriptive and the following three chapters will be analytical. The seventh chapter will be the conclusion which will be constructed on the building blocks of the previous chapters. Chapter 8 will be the reference section.

Descriptive	**Analytical**	**Conclusion**	**References**
CH 1, 2,3	CH 4,5,6,	Ch 7	Ch 8

The first chapter presents the general context of the report. It includes introduction for the problem analysis, research design and research methodology as well as data collection methods. Definition of sustainable development from different actors, and the rationale for having an index to measure environmental sustainability is also presented. Also a brief presentation of Environmental sustainability index (ESI) is included in order to set up the stage for the project. Other alternative

measures of sustainability are put forward to show the options to measure sustainability. In the section about environmental sustainability implementation, the essential elements for building an infrastructure for sustainable development are discussed. In addition to that the Swedish and Danish government's sustainability development objectives are presented. The reason for including this part was to provide the current understanding of the concept.

The following two chapters present the Environmental Sustainability Index (ESI). In the second chapter, the model of ESI and how the countries are clustered are explained. In the third chapter, the components, indicators and variables of ESI are analysed in detail for all Nordic countries except Iceland. Iceland will not be included as one of the Nordic countries in the project. (It scores on the 8th rank.) Because of its low population (279,384) its isolated structure, information limitation about the country. Also not all the Nordic countries will deeply be analysed like Denmark.Although profound cultural analysis between those countries including Iceland will improve the overall quality of the project. At the end of the third chapter, the criteria for indicators and weaknesses of ESI are studied. The reason to include this little section to the end of the chapter is to be objective about the index or the tool that is used for the project.

These first three chapters in the project are descriptive in nature as mentioned at the beginning while the next three chapters are analytical.

Chapter four introduces number of the key indicators as well as some variables that have an important impact on Denmark's placing on the ranking. Those indicators are eco-efficiency, private sector responsiveness, reducing air pollution, reducing water pollution, (Environmental stress and risks) air quality and water quality (environmental systems). Especially the last four indicators are the ones Denmark scores very low in and those areas can pose significant challenges to the country as it faces the future.

Chapter five will deal with, SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) of Danish environmental governance. Environmental governance' refer to a policy making process in

which government and other actors play a role. Some of the strengths of Denmark in environmental governance can be a way to solve environmental problems that had mentioned in the previous chapters. (Air quality, water quality, reducing water and air pollution). In this chapter, European Union and Denmark with reflect to compliance is also analyzed. At the end of the chapter, the analysis for political shift in Denmark in 2001 is examined.

Chapter six is the evaluation of Danish experience, and about what makes Denmark different from other Nordic countries. All Nordic countries share similar political systems but their administrative traditions and systems diverge. As an example, Norway and Denmark are decentralized while Sweden and Finland are centralized. Also their innovation systems follow different trajectories. This chapter identifies some of the major dimensions where Nordic innovation systems differ between each other.

Chapters seven involves the conclusions drawn from the project along with the discussion. Conclusion gives the answers to the main research questions.

The first three chapters of the project is basically the interpretation of the environmental sustainability index and sustainable development. This descriptive part of the project is providing the point of departure and context of the project.

The next three chapters are the analysis of the data that is collected in the previous chapters. The fourth chapter is the analysis of indicators and variables that have impact on Denmark's placing on the ranking. Chapter five is mainly an analysis involving Danish governance. The strengths, weaknesses, opportunities and threats of Denmark are presented in the SWOT table with factors. Then all those factors are described clearly to examine and investigate the potential for Danish environmental governance. SWOT method helps for further thinking about the Danish situation. In chapter six Danish case in the Nordic context is analyzed. Some of the similarities and differences are presented. And the information from all those analysis chapters provided the building blocks of conclusion.

1.1.1. Research Methodology

In this section the methods that applied to answer the questions in problem formulation is described. The purpose is to show how the research for the project is carried out with the weaknesses and strengths of the chosen approach. First time, when the results for the Environmental sustainability

Index (ESI) are encountered, the scores for the Nordic countries except Denmark was not exceptional. Since all Nordic countries are known to be affluent, industrialised with generous welfare support, well-developed social policies, high educational levels, responsible justice systems and stable democracies. And those characteristics most of the time lead the potential to be an ecologically aware nation. (In the ESI context, environmentally sustainable country.) It was mainly unexpected to see that Denmark lags far behind the other Nordic countries. After analyzing the indicators of (ESI), pieces of information from the data results reveal itself to a certain part of the whole picture. Since environmental indicators as a rule are designed to help track environmental progress and analyze environmental policies but not for to provide full picture of environmental issues. The environmental indicators are thus only one tool for evaluation. They need to be supplemented by other qualitative and scientific information to acquire their full meaning. Especially the concepts of environment and sustainability are multifaceted; the driving forces behind the indicator data results can not simply give themselves to a basic score number. It would be an oversimplification and a naïve approach to anticipate a great deal from ESI results. But still by analyzing the weak areas of Danish environment in the sense that focusing on the indicators with the lower scores in ESI one can answer part of the problem formulation questions. At the beginning, before further literature study, cultural analysis was suggested to answer the questions in problem formulation. After using Hofstedes 5D model for cultural analysis, it found out that culturally the Nordic countries are identically similar so another method is required. In the final version of the project, the theory of sustainable development is used which is explained in the sections 1.2 and 1.7.

The project is performed mostly with an inductive method since it relies on data collected from Environmental sustainability Index. The variables and the indicators serve as the information pieces as a foundation to find out the reasons for Denmark’s low performance in the index. Inductive

reasoning is from the specific to the general. In the project, mainly this reasoning is utilized to derive general principles by empirically examining and testing particular facts or indicators of a large number of data from environmental literature. Deductive reasoning is used in order to answer the influence of regime shift for Danish environmental performance. The theories that are gathered from section 1.3 is applied to Danish new political regime shift in section 5.3.Basically, status quo view put into operation in the Danish context to see if this view is an answer to sustainable development. Also in order to get a better view of Danish governance, SWOT analysis is performed and some valuable conclusions are also maintained from this method.

1.1.2. Data collection

In this project, data have been collected from different sources. A combination of published books, reports, articles and web pages have been used as back ground information on sustainable development, sustainability indicators, and environmental policies of Nordic countries. The data used in the project are reliable since they were identified on the basis of careful review of the environmental literature, expert advice, statistical analysis as well as peer review comments. Mainly the reason for using the web sites in the project was to reach to the most current statistical data involving environmental performances of the Nordic countries. Fortunately, all the data sets are accessible with their background information. In that way the weaknesses, strengths and the reliability of the data can be judged. The published books are not always the best source for the yearly changing index results. So although the problematic nature of internet sources is acknowledged, still for the sake of indicator studies, it was necessary to use the updated information for the objectivity of the project. When it comes to theory, background information and analysis, the published articles and textbooks are utilized. All the references can be seen at the end of the project.

1.2. Views on sustainable development

Sustainable development, although a widely used phrase and idea, has many different meanings and definitions. Therefore it brings about many different responses. In broad terms, the concept of sustainable development is an attempt to combine growing concerns about a range of environmental issues with socio-economic issues. (Hopwood et al, 2005)

For the last couple of hundred years the environment has been largely seen as external to humanity, mostly to be used and exploited, with a few special areas preserved as wilderness or parks.

Environmental problems were considered mainly as local. In general, the relationship between people and the environment was taken in as humanity's triumph over nature. This Promethean view (Dryzek, 1997) was that human knowledge and technology could overcome all obstacles including natural and environmental ones. This view was linked with the development of capitalism, the industrial revolution and modern science. As Bacon, one of the founders of modern science, put it, 'The world is made for man, not man for the world'. (Hopwood et al, 2005)

Environmental management and concern amongst most businesses and governments, apart from local problems and wilderness conservation, was at best based on natural resource management. A key example was the ideas of Pinchot in the USA (Dryzek, 1997), which recognized that humans do need natural resources and that these resources should be managed, rather than rapidly exploited, in order to ensure maximum long-term use.(Dobson, 1991)

The concept of sustainable development is the result of the growing awareness of the global links between increasing environmental problems, socio-economic issues to do with poverty and inequality and concerns about a healthy future for humanity. It strongly links environmental and socio-economic issues. The first important use of the term was in 1980 in the World Conservation Strategy (IUCN *et al.*, 1980). This process of bringing together environmental and socio-economic questions was notably expressed in the Brundtland Report's definition of sustainable development

as meeting ‘the needs of the present without compromising the ability of future generations to meet their needs’ (WCED, 1987, p. 43).

Brundtland’s definition and the ideas expressed in the report *Our Common Future* recognize the dependency of humans on the environment to meet needs and well-being in a much wider sense than merely exploiting resources: (WCED, 1987, p. 5). Rather than domination over nature the lives, activities and society are nested within the environment (Giddings *et al.*, 2002). The report stresses that human beings depend for security and basic existence on the environment; the economy and the well-being now and in the future need the environment.

It also points to environmental problems are not local but global, so that actions and impacts have to be considered internationally.

According to (Rees, 1995p:350) There are three structures that need to change for society to achieve sustainable development.

Political structures	Economic structures	Human–environment relationships

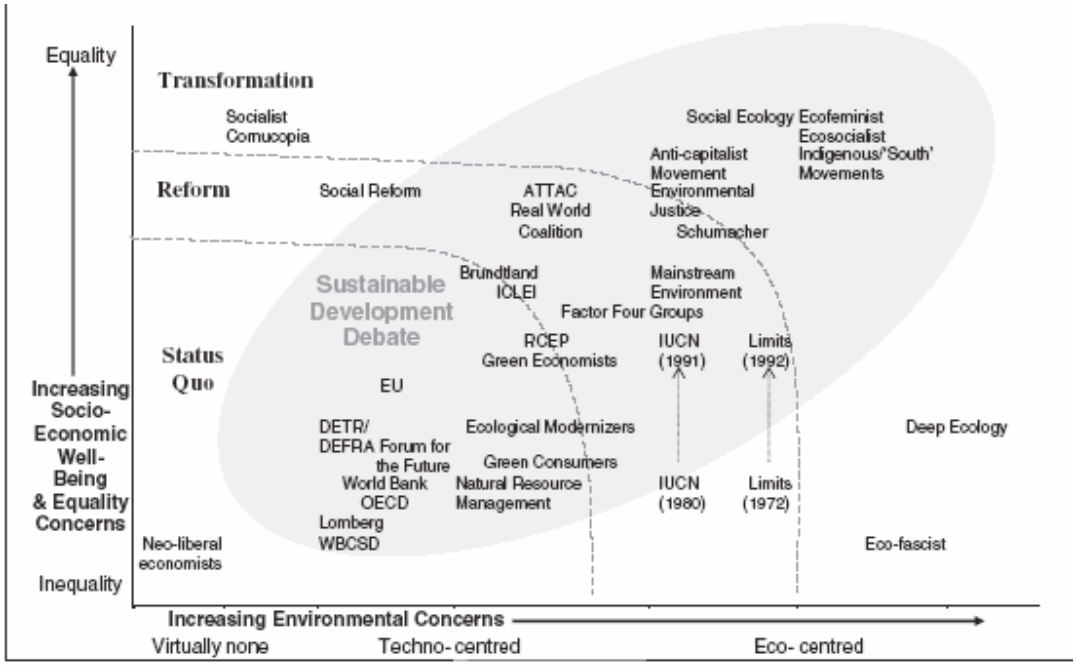

Figure 1. Mapping of views on sustainable development

Figure 1.2

In the figure above environmental and socio-economic standpoint are placed on two separate axes. The socio-economic axis deals with the level of importance given to human well-being and equality . The environment axis involves the priority of the environment from technocentred (low) to ecocentred.(high) The central shaded area of the map shows the variety of views within the sustainable development debate; combining socio-economic and environmental issues.

Environmental sustainability can be achieved in the society and there are three broad views on the nature of changes. (Rees, 1995 p: 351)

- Within the present structures – status quo;
- With a fundamental reform without a gap with the existing arrangements
- With a radical transformation

More detailed picture of those views can give a better idea of current sustainable debate. O'Riordan (1989) suggested a mapping methodology to make sense of confusing and different interpretations of sustainable development. He labelled environmental views from strong ecocentric to strong

techno centric. Generally according to Hopwood et al (2005), ecocentrics are inclined to social and economic equity and redistribution while technocentrics have a tendency to approve the economic and political status quo.

1.2.1. Status Quo

Those who take status quo approach are aware of the need for change but see neither the environment nor society as facing insurmountable problems. Adjustments can be made without any fundamental changes to society, means of decision making or power relations (Hopwood et al, 2005)

Development is identified with growth and economic growth is seen as part of the solution for the supporters of the status quo. They are in favour for the changes in the role of government over recent decade's .Especially with the reduction in the progressive nature of taxation, cuts in the social wage, privatization and reduction in regulation. (Hopwood et al, 2005)

For status quo supporters, increased information, changing values, improved management techniques and new technology all operating through the market are the best means to achieve sustainable development.

The World Business Council for Sustainable Development (1998) sees no conflict between the growth of the global market and environmental stability: '*we can have an open vigorous and healthy trading system and achieve sustainable development*'.

Lomborg (2001) p: 32 challenges most of the claims of those concerned about the environment, poverty and hunger. He states that to improve the 'environmental quality of the developing world, securing growth so as to lift these people out of hunger and poverty is of the utmost importance since . . . only when we are sufficiently rich can we start to . . . deal with environmental problems'.

Supporters of the status quo are reluctant to use laws and regulations. Instead, consumer power, informed about sustainability issues and based on lifestyle choices, will combine with 'green'

capitalists who practice ‘corporate citizenship’ and ethical business to achieve sustainable development. (Elkington and Burke, 1987).

It is assumed by status quo supporters that the existing governmental and commercial systems can be pushed towards improvements with use of management techniques such as EIA (environmental impact assessment), EMAS (eco-management and audit system), cost/benefit analysis, BATNEEC (best available techniques not entailing excessive cost) and BPEO (best practicable environmental option). In parallel, technical economic tools such as modest environmental taxes, pollution trading permits and ethical shares will encourage the move to sustainable development.

Solow (1974) p: 12-13 claims technology can replace nature.

1.2.2. Reform

Supporters of reform approach accept that there is an increase in problems with environment, being critical of current policies of most businesses and governments and trends within society, but do not consider that a fundamental change is necessary. (Hopwood et al, 2005) They locate the root of the problem in imbalances and a lack of knowledge and information in society. They concentrate on technology, good science and information, modifications to the market and reform of government. This group includes range of people, some in government and public agencies, but it is largely dominated by academics and mainstream NGO experts.

The reformists give a principal support for a remarkable increase in energy efficiency and change in energy use from fossil fuels to renewable sources (Flavin &Lenssen, 1994).

Hawken *et al.* (1999) claims that these changes can imply market opportunities for businesses and they should follow the changes, both for the environment and profits In general it is declared that the new technologies will offer wider economic and social benefits for humanity as well as protecting the environment.

Reformers accept that government has a key role in moving towards sustainable development as business will need pushing, and in some cases controlling, taxes and subsidies changing, targeting of research and disseminating of information. (Girardet, 1999 p: 7)

1.2.3. Transformation

Transformationists consider mounting problems in the environment and/or society are originated from the fundamental features of society today and how humans interrelate and relate with the environment. They claim that a transformation of society and/or human relations with the environment is necessary to avoid a crisis and even a possible future collapse. (Hopwood et al, 2005)

Deep ecologists' primary concern is the environment, with the stress on the intrinsic value and needs of nature and the environment, while human needs come very much second. In the eight points of the deep ecology platform (Naess, 1989p:16) there is little on human needs and nothing on equity.

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A transformation view of sustainable development has a strong commitment to social equity, with a view that access to livelihood, good health, resources and economic and political decision- making are connected. (Hopwood et al, 2005)

..*" Environmental justice is about social transformation directed toward meeting human need and enhancing the quality of life – economic equality, health care, shelter, human rights, species preservation and democracy – using resources sustainable' and that achieving it 'demands major restructuring of the entire social order……"*
Hofrichter (1993, pp. 4–5)

Within the broad range of transformative perspectives on sustainable development, there is a constant change of ideas.

1.2.4. Analysis

All the above views about sustainable development agree that society needs to change. But the tools and actors for those changes are different and there is no unified philosophy of sustainable development. There is an essential divide between the supporters of status quo and transformation in their concept of and approach to sustainable development.

The status quo approach sees change through management, top down and incremental, of the existing structures of decision-making. The transformation view is that change will be mainly through political action working both in and outside the existing structures.

The usual model for sustainable development is of three separate but connected rings of environment, society and economy, with the implication that each sector is, at least in part, independent of the others. Defenders of the status quo does not see the root cause of lack of sustainable development in the fundamental linkage, rather they see it in the lack of knowledge and appropriate mechanisms

This view allows for trade-offs between environmental and social issues such as increase in growth or accepted pollution. These trade-offs shows a continued indefinable divide between the environment and humanity. The reality is that humanity is dependent on the environment, with society existing within. (Giddings *et al.*, 2002)

Currently, the status quo view leads policy, but their policies are an insufficient answer to the needs of sustainable development; it is argued that they have used the sayings of sustainable development to continue with and justify business as usual (Kothari, 1990).

Fundamental change in the relationship of human, environment and power structures is necessary. However, transformation is not practical for the time being and reform is better than nothing.

1.3. Definitions of Sustainable Development

It seems that most of the literature on sustainable development has confused its definition with the conditions for achieving sustainability .The term has been criticized as ambiguous and open to a wide range of interpretations, many of which are contradictory. The confusion, it appears, has been caused because the terms sustainable development, sustainable growth, and sustainable use have been used interchangeably, as if their meaning was the same. But in fact they are not. Sustainable growth itself is a contradiction in terms. Nothing physical can grow indefinitely. Sustainable use is applicable only to renewable resources, it means using them at rates within the carrying capacity for renewal. Similarly, sustainable development, as presented in the World Conservation Strategy (1980), is in fact a strategy to improve the quality of human life while living within the carrying capacity of supporting ecosystem. (Dobson, 1991)

Further confusion about sustainable development arises as people use the same words to mean a wide divergence of views on the goals, routes and the methods of moving towards sustainable development. This is further complicated because, as in many political issues, some people may say one thing and mean another. (Hopwood et al, 2005p:146)

So it is important to stick with one definition during the course of the project.

‘’…..Sustainability does not mean sustained growth. Sustainable development improves the economy without undermining the society or the environment. Sustainable development focuses on improving our lives without continually increasing the amount of energy and material goods that we consume. A sustainable community does not consume resources -- energy and raw materials -- faster than the natural systems they come from can regenerate them…”

Maureen Hart, Guide to Sustainable Community Indicators, 1999

Webster's New International Dictionary

"Sustain - to cause to continue (as in existence or a certain state, or in force or intensity); to keep up, especially without interruption diminution, flagging, etc.; to prolong." ***Webster's New International Dictionary****. (Springfield, Mass.: Merriam-Webster Inc., 1986)*

Caring for the Earth

"Improving the quality of human life while living within the carrying capacity of supporting eco-systems."

IUCN/UNEP/WWF. Caring for the Earth: A Strategy for Sustainable Living. (Gland, Switzerland: 1991).

(IUCN - The World Conservation Union, UNEP - United Nations Environment Programme, WWF - World Wide Fund for Nature).

Thomas Jefferson Sustainability Council

"Sustainability may be described as our responsibility to proceed in a way that will sustain life that will allow our children, grandchildren and great-grandchildren to live comfortably in a friendly, clean, and healthy world that people":

- Take responsibility for life in all its forms as well as respect human work and aspirations;
- Respect individual rights and community responsibilities;
- Recognize social, environmental, economic, and political systems to be inter-dependent;
- Weigh costs and benefits of decisions fully, including long-term costs and benefits to future generations;
- Acknowledge that resources are finite and that there are limits to growth;
- Assume control of their destinies;
- Recognize that our ability to see the needs of the future is limited, and any attempt to define sustainability should remain as open and flexible as possible.

(http://avenue.org/Gov/TJPDC/sustain.html)

Our Common Future

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Page 8, World Commission on Environment and Development. Our Common Future. (Oxford, Great Britain: Oxford University Press, 1987). (Frequently referred to as the Brundtland report after Gro Harlem Brundtland, Chairman of the Commission)

World Business Council on Sustainable Development

"Sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality and social equity. Companies aiming for sustainability need to perform not against a single, financial bottom line but against the triple bottom line."

"Over time, human and social values change. Concepts that once seemed extraordinary (e.g. emancipating slaves, enfranchising women) are now taken for granted. New concepts (e.g. responsible consumerism, environmental justice, intra- and inter-generational equity) are now coming up the curve."

(http://www.wbcsd.ch/)

Wolfgang Sachs, Planet Dialectics

"Sachs has such a problem with the term sustainable development. He says coupling the two words "shifted to locus of sustainability from nature to development: while 'sustainable' previously referred to natural yields, it now refers to development … the meaning of sustainability slides from conservation of nature to conservation of development." A major concern of his is that to sustain development, nature becomes the 'factor to be watched,' instead of sustaining nature which watches development….

Wolfgang Sachs Planet Dialectics, explorations in environment and development", London, Zed Books, *1999*, p.p 81

From most of the definitions, it can be seen that the integration of environmental issues into social, economic and institutional structure is the major target of environmental sustainability. There is no universally accepted definition for sustainable development.

From all those definitions, it can be concluded that sustainable development aims to ensure that physical, social, environmental and economic factors are considered together to make sure the needs for the present can be met without compromising the ability of future generations to meet their own needs.

This definition is a shift from the traditional idea of sustainability as primarily ecological, to a framework that also takes into consideration the human and social contexts of the development.

1.4. The necessity of environmental index

There are many purposes of having environmental indicators. But there are some major ones such as *tracking environmental progress* which can be done by monitoring the environment and changes over time. Another purpose is to better *integrate environmental concerns into sectoral and economical policies*. In that way, indicators can provide the tool that is necessary to encourage governments to perform better in environment. (Linster, 1990p:6)

The indicators further can also help to identify the drivers of environmental sustainability that can facilitate to choose the policies that can promote sustainability. (Esty, 2000) P: 3 Governments will like to know where they stand in protecting critical resources, and which environmental policies deliver good results.

"…Fundamentally, it is high time the environmental world recognized that" what gets measured matters". Historically, environmental decisions have been based, too often, on educated guesses but not hard facts. The lack of analytic rigor has made the environmental field seem "soft" and has allowed critics to dismiss the seriousness of pollution control and natural resource management issues. Of course, a more data-driven approach to environmental decision making will not solve all environmental problems.…..."

Daniel Esty, 2001, Environmental Law reporter P: 10610

As Esty claims indicator based policy making is only a starting point for policy makers .It gives them a capacity for more decisive policy judgements and knowledge building opportunities for future.

Other than governments also for companies, ESI is crucial nowadays. They are increasingly eager to find ways to improve their eco-efficiency and to assure that they are achieving maximum resource productivity. Good environmental data make this type of analysis easier to do.
(Schmidheny, 1996 p: 13)

All environmental indicators have some fundamental characteristics .They address the current state of environment, pressures exerted on the environment and the societal response to those pressures. Each fundamental element is necessary for a different purpose.

Indicators of environmental conditions correlate to the quality of environment and quality and quantity of natural resources. So in that way they represent the final objective of environmental policies. (Linster, 1990)

Indicators of environmental pressures describe stresses from human activities exercised on the environment and natural resources. This characteristic of the environmental indicators give an idea about the trends of environmental significance. So the most critical human –induced exercises can be recognized and responded straight away. (Linster, 1990 p: 3)

Indicators of societal responses demonstrate the degree to which society react to environmental changes and concerns. This aspect of environmental indicator is also necessary since it can prevent further human-induced damage on the environment and it can facilitate to preserve and conserve nature and natural resources. (Linster, 1990p:4) It is also a good signpost to indicate where the society stands.

Environment, Economy and policy making are not independent of each other, they are interrelated. So integration among them is a necessity to sustain the environment. Environmental indicators can help to incorporate environmental concerns into sectoral policy making by revealing their interactions with the environment. Those sector policies of concern so far are transport, energy, forestry and agriculture. Environmental indicators can be utilized for some broad goals concerning the efficiency of human activities and sustainability of natural resources and development. However, they can not yet provide a mechanical measure of environmental performance.
(Linster, 1990)

OECD experience illustrates that environmental indicators have proven to be cost-effective and powerful tools to track environmental progress and measure environmental performance. Nevertheless further policy relevance and increased quality of existing indicators are required. (Lorentsen, 2004)

Additionally, ecological surprises are inevitable because of the complexity of the interactions and because of limitations in current understanding of the dynamic properties of ecosystems. This also makes it difficult and necessary to design an index that can address sustainability. (MEA, 2005)

1.5. Environmental Sustainability index

According to ESI, environmental sustainability is defined as the ability to maintain valued environmental assets over the next several decades and to manage problems that emerge from changing environmental conditions.

In section 1.3 of the project, the definition of sustainable development is also formulated:

Sustainable development aims to ensure that physical, social, environmental and economic factors are considered together to make sure the needs for the present can be met without compromising the ability of future generations to meet their own needs.

In line with the above definition and ESI,(Levy, 2002 p:19) environmental sustainability is a process that requires focused attention on the part of governments, the private sector, communities and individual citizens.

The ESI combines measures of current conditions, pressures on those conditions, human impacts, and social responses because these factors collectively constitute the most effective metrics for measuring the prospects for long-term environmental sustainability, which is a function of underlying resource endowments, past practices, current environmental results, and capacity to cope with future challenges.(Levy, 2002 p:21)

The Environmental Sustainability Index (ESI) measures overall progress toward environmental sustainability for 142 countries. In the architecture of the ESI, all indicator scores are calculated in relative terms and then averaged to generate the composite scores. This presumes that the countries are fundamentally comparable. Comparative analysis supports efforts to identify critical environmental trends, track the success (or failure) of policy interventions, benchmark performance, and identify "best practices."

That is why; in the project ESI is chosen as a tool to evaluate the Nordic countries environmental policies towards environmental sustainability. The scores or the results in ESI are proximate indication of the political commitment to environmental sustainability trends. It serves as a common denominator for all four Nordic countries to measure their performance as a result of their policies.

The ESI seeks to make the concept of environmental sustainability more concrete and functional by grounding it in real-world data and analysis

In the construction of ESI 2002, there are five main components divided into 20 indicators. These were identified on the basis of a careful review of the environmental literature, expert advice, statistical analysis as well as peer review comments and critical assessments of the 2001 ESI.

Then each indicator has associated with a number of variables that are empirically measured .Those 20 indicators measure many distinct dimensions of environmental sustainability; it is possible, moreover, for countries to have similar ESI scores but very different environmental profiles. But in Denmark's case, it is contrary to what one can expect. It's environmental profile matches with other Nordic countries, it is considered as a pioneer with its relatively developed domestic environmental policies, and with its driving force to push for higher environmental standards in European Environmental policy. (Andersen, 1997 p: 282)But still it scores quite poorly.

1.6. Other national and international measures of environmental sustainability

Indicators of sustainability are different from traditional indicators of economic, social, and environment. Sustainability indicators reflect that the three different segments (economic, social and environment) are very tightly interconnected in contrary to traditional indicators. Traditional indicators see those segments entirely independent of the other parts.
(Hart, 1999)

The first significant study on indicators at international level within an institutional structure has been started by the State of the Environment Unit of OECD in 1991. OECD studied on the "state of the environment indicators" (descriptive indicators) that is used in determination of the current state of the environment. (Akalin, 1998 p: 13ff)

The current emphasis has shifted from (descriptive indicators) to (performance indicators), with the studies of Adriaanse from the Netherlands in 1993. The major difference between them is descriptive indicators are useful for showing trends in the state of the environment while performance indicators show not only trends but distance to target.((Akalin, 1998 p:76)

The measure of well-being as designed by the World Bank (1983), physical quality of index as devised by Overseas Development Council (1979) and Human Development Index as developed by UNDP (1990) converge on four indices, per capita national income, and life expectancy at birth, infant and child survival rates, and adult literacy rates. (Macnaughten et al, 1997)

But these indices did not conform to the indices of sustainable development which lay emphasis on maximizing the economic benefits from a given ecological milieu within its carrying capacity and thus minimizing the risks and hazards to environment. A more liberal conception of sustainable development implies improvement in the well-being of the people as reflected in the domains of health, education, fulfilment of basic needs, social security, justice equality, freedom and self respect.(Hart, 1999)

During the last years several liberal alternative approaches to measuring national environmental sustainability have emerged. Prescott- Index combines a number of measures of human welfare and ecosystem health, producing three aggregated measures: a Human Wellbeing Index, an Ecosystem Wellbeing Index, and a Wellbeing Index which is the average of the other two (Prescott-Allen, 2001). The Consultative Group on Sustainable Development Indicators (2002), in collaboration with the UN Commission on Sustainable Development (CSD), has produced a "straw" set of sustainability indicators organized around the CSD's indicator framework. These straw indicators include aggregated measures on the environment, social issues, the economy, and institutions, as well as an average of these four. (Esty, 2001p: 10611.)Finally, the Ecological Footprint, produced by the Redefining Progress Institute, provides a third alternative. **(**Wackernagel, M et al., 2001)

With the change of ideas about the concept of sustainable development, the content and the information provided by the indexes also changed. The content shift was from economic and demographic elements towards social elements such as increase in social wellbeing and structural transformation based on social norms and values.

1.7. Implementation of sustainable development

For sustainable development to occur the present attitude that is consumption and growth oriented focus based on assumptions of unlimited resources and infinite environmental support capacity should be altered. The new transformed focus should be on forms of developing sustainable over long term. This paradigm shift is very difficult to achieve and it can take decades for a society to realize it. (O'Neal, 1993)

The potential benefits for this mentality shift are tremendous. Some of the benefits are longer range focus for planning, analysis, project design and assessment, improved efficiency of resource conservation and use, increased reliance on renewable resources. However, the changes required to shift to a more sustainable focus are many and complex involving social, cultural, economic and hard science considerations. (Rees, 1995p:355**)** The success of this shift relies on extensive

coordination among government agencies at all levels as well as on an informed and involved public that understands the dimensions of and keys to sustainability. (O'Neal, 1993)

According to O'Neal, there are eight elements necessary to build sustainable development infrastructure. Environmental education, indicators, forecasting, analysis, information transfer, pollution prevention, resource conservation and finally the support from academic institutions.

Strengthening the environmental education programs in school systems by incorporating sustainability issues and knowledge about economic and environmental values of natural resource systems is a good asset. In order to construct sustainable development, there is also a need for economic and environmental indicators for informing public and decision makers. Availability of such indicators can facilitate business and government communities to share information. Currently, forecasting on environmental quality, economic trends, public values, and changing demographics that is practised is not integrated and coordinated. Monitoring on those areas should be improved in a way that sustainability related questions can be addressed. There is also a requirement from businesses and all levels of government for identification of a tool and related training in order to analyze potential impacts on environmental and ecological sustainability. By the help of those analytical tools, necessary research or action can be initiated.

Governments, businesses and academia need facilitation of information transfer opportunities. This opportunity can be obtained by conferences, workshops. In that way, sustainable development concept can be more widespread. In order to prevent pollution, the governments, public and private sectors at all levels should cooperate. Effective conservation of both natural and man-made resources and materials is an essential element of any approach to sustainability.

The training and research skills available at public and private institutions are essential for the infrastructure. Also the academic institutions can provide support and direction to long-term effort since it is an evolving dynamic concept.

Furthermore, to effectively integrate environment and development in the policies and practises, it is essential to develop and implement integrated enforceable and effective laws and regulations that are based upon sound social, ecological, economic and scientific principles. **(**Bartelmus, 1994**)** Additionally, it is also critical to develop workable programmes to review and enforce compliance with laws, regulations and standards that are adopted.

O'Neal had suggested those eight elements in 1993, and in 2005 it is possible to see the actual implementation of sustainable development at government level. The concept is more refined and better formulated in the present. And the international approach, biodiversity, health areas are included.

As an example, on 1 January 2005, the Ministry of Sustainable Development takes over responsibility for environment issues from the Ministry of the Environment in Sweden. Its areas of responsibility will include energy issues, emissions trading, construction and housing, and responsibility for coordinating the governments work on sustainable development. Swedish National strategy for Sustainable Development will be the overall goal of government policy which means that all political decisions must take into consideration long-term economic, social and environmental consequences.

In the Swedish Strategy for Sustainable Development for 2004, the government gives priority to eight core areas encompassing the most important elements of a sustainable society:

(Ministry of sustainable development of Sweden, 2004)

1. The future environment
2. Limitation of climate change
3. Population and public health
4. Social cohesion, welfare and security
5. Employment and learning in acknowledge society
6. Sustainable economic growth and competitiveness
7. Regional development and regional conditions
8. Development of sustainable community planning

The Danish sustainable Development Strategy is based on eight objectives and principles**:**

(Millennium development goals progress report, 2004)

1. The welfare society must be developed and economic growth must be decoupled from environmental impacts.
2. There must be a safe and healthy environment for everyone, and we must maintain a high level of protection
3. A high degree of bio-diversity and protect ecosystems must be secured
4. Resources must be used more efficiently.
5. Actions should be taken at an international level.
6. Environmental considerations must be taken into account in all sectors
7. The market must support sustainable development
8. Sustainable development is a shared responsibility and progress must be measured

CHAPTER 2 what is the environmental sustainability index?

2.1Modelling of ESI

The model of ESI is altering every year and this sometimes has an impact on the rankings of the index. This section will look at the possible reasons for Denmark's change in ranking. In 2001 Denmark was scoring on the10th rank and in 2002, it dropped to 31st rank. It is a major drop in one year for a country like Denmark.

There had been some changes such as addition, replacement and deletion of indicators &variables composition from year 2001 to year 2002. In 2001 there were 67 variables, 22 indicators and 5 components. In 2002, on the other hand, there were 68 variables, 20 indicators and again 5 components in the model of ESI. The six indicators – Regulation and Management, Environmental information, Reducing public choice distortions, Protecting international commons, Global scale funding participation, and International commitment do not exist in 2002.Instead four indicators- Governance, Participation in international collaborative efforts, Reducing greenhouse gas emissions, Reducing transboundary environmental pressures exist.

It is criticized in the ESI 2001that the ESI is calculated as an unweighted average of the indicator scores and this structure resulted in giving greatest weight to the social and institutional capacity component. Since, In ESI 2001, there exist seven indicators in the social and institutional capacity component, five each in the environmental systems and reducing stress component, three in the global stewardship component, and two in the reducing human vulnerability component
(Levy, 2001 p: 11).

In 2002 ESI, two of the indicators in that component: Environmental Information was merged into Capacity for Debate (on the assumption that effective debate cannot take place without adequate information), and Regulation/ Management was combined with Reducing Public Choice Distortion

to produce a new indicator called Environmental Governance. This resulted with a structure that gave greater weight to actual environmental performance measures (Environmental Systems, Reducing Stresses, and parts of Global Stewardship), and proportionately less weight to measures of Social and Institutional Capacity.

This is strength of ESI since it updates itself every year either by changing its indicators or replacing the variables in different indicator categories. Indicators need to be viewed in a dynamic context. They are subjected to revision in order to reflect the changing nature of policy perspectives and public perceptions regarding the seriousness of different multi faceted environmental problems. (Lindsey, 1990p:8)

In 2001, Denmark was having many missing data. The ESI set out 50 variables for which it could reasonably be expected that any country could have coverage if it wanted to. Out of this 50 variable, Denmark was missing 7 of them. But in 2002, the missing variable percentage was only 5%.This filling of the missing data might easily had an influence on Denmark's score. Those missing data are mainly the ones that Denmark scored very poorly such as child death rate from respiratory diseases, death rate from intestinal infectious diseases, phosphorous concentration, electrical conductivity etc. (2002 values can be seen in Chapter 3)

There had also been number of indicators and variables that Denmark scored very high in 2001.As an example for variable, levels of environmental competitiveness can be given. Denmark scored very high in that variable in 2001 while it did not score as good in the substitute variable private sector environmental innovation in 2002. Both of those two variables are part of private sector responsiveness indicator.

Other than the selected indicator and variable changes, there can be many other reasons for this sudden drop of Denmark in the ranking in ESI. The governance is also a major factor that shapes environmental sustainability. Environmental sustainability is a process that requires focused attention on the part of governments, the private sector, communities and individual citizens. The

institutional capacities of the political and administrative system, in combination with the influential national political style, may be enough to be able to make a nation environmentally sustainable.

Environmental problems in general attracted positive responses from all political parties in Nordic countries. But mainly it is the social democratic parties played an important role in Denmark, Sweden, and Finland and a less important role in Norway. The left wing parties are more outspoken on environmental problems and solutions in the Nordic countries. (Christiansen, 1996.p:43)

MODEL OF ESI

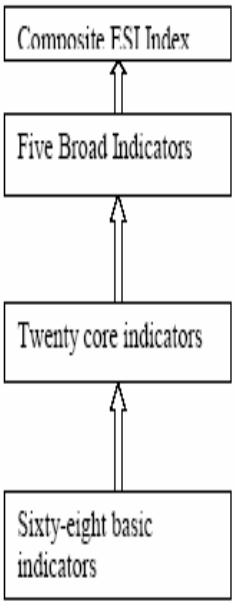


Figure 2.1

Environmental sustainability is defined according to ESI as the ability to maintain valued environmental assets over the next several decades and to manage problems that emerge from changing environmental conditions.

Sustainability is also recognized as a multifaceted concept that must encompass a range of ecological and environmental, public health values.

The Environmental Sustainability Index (ESI) measures overall progress toward environmental sustainability for 142 countries. In the architecture of the ESI, all indicator scores are calculated in relative terms and then averaged to generate the composite scores. This presumes that the countries are fundamentally comparable.

In ESI equal weighting is used across the 20 indicators instead of putting special emphasis on special issues or indicators. The main reason for this choice is that “environment” refers to a wide range of issues including air and water pollution, waste management, toxic exposures, as well as range of natural resource management issues. And equal weighing reflects this balance of environmental issues that countries across the world must address. In addition, the ESI architecture accounts for an environmentally sustainable country is one which generates the bulk of the most valuable environmental services – such as clean air, plentiful water, arable land, biodiversity from internal resources. Similarly, the ESI assumes that a sustainable country sets aside a significant portion of its land as protected wilderness

The ESI seeks to make the concept of environmental sustainability more concrete and functional by grounding it in real-world data and analysis. In the ESI, it is stated that the lack of a current and reliable data across the entire range of environmental sustainability issues has hindered efforts to identify the determinants of environmental success and long-term sustainability. Since the concept of sustainability is fundamentally centred on trends into the future, the ESI explicitly goes beyond simple measures of current performance. The ESI demonstrates that it is possible to derive quantitative measures of environmental sustainability that are comparable across a large number of countries

ESI-based analysis reveals some of the critical determinants of environmental performance: low population density, economic vitality, and quality of governance. Some of these variables have long been identified as theoretically important. The ESI provides empirical support for these theories.

2.2 Cluster Analysis

Scientific knowledge does not allow specifying precisely what levels of performance are high enough to be truly sustainable, especially at a worldwide scale. Also it is difficult to identify in advance if any given level of performance can be carried out in a lasting manner. Therefore a comparative index is built in ESI. To help facilitate relevant comparisons across countries with similar profiles, a cluster analysis is used. Cluster analysis provides a basis for identifying similarities among countries across multiple dimensions. The cluster analysis performed on the ESI data set reveal five groups of countries that had distinctive patterns of results across the 20 indicators.

Cluster analysis results Table 2.2

Cluster1 high human vulnerability, moderate system & stresses	Cluster2 low vulnerability moderate system &stresses	Cluster3 low vulnerability poor system &high stresses	Cluster4 moderate vulnerability moderate system &stresses low capacity	Cluster 5 moderate vulnerability moderate system &stresses average capacity
Angola Benin Bhutan Bolivia Burkina Faso Burundi Cambodia Cameroon Central Af. Rep. Chad Congo Ethiopia Gabon Gambia Ghana Guatemala Guinea Guinea-Bissau Haiti Ivory Coast Kenya Laos Liberia Madagascar Malawi Mali Mauritania Mozambique Myanmar Nepal Nicaragua Niger Nigeria Pakistan Papua New Guinea Paraguay Rwanda Senegal Sierra Leone Somalia Sudan Tanzania Togo Uganda Zaire Zambia	Australia Canada Estonia Finland Iceland Ireland Israel New Zealand Norway Sweden United States	Austria Belgium Czech Republic Denmark France Germany Hungary Italy Japan Macedonia Netherlands Poland Slovakia Slovenia South Korea Spain Switzerland United Kingdom	Iraq Kazakhstan Kuwait Libya North Korea Oman Russia Saudi Arabia Trinidad and Tobago Turkmenistan Ukraine United Arab Emirates Uzbekistan	Albania Algeria Argentina Armenia Bangladesh Bosnia and Herze. Botswana Brazil Bulgaria Byelarus Chile China Colombia Costa Rica Croatia Cuba Dominican Rep. Ecuador Egypt El Salvador Greece Honduras India Indonesia Iran Jamaica Jordan Kyrgyzstan Latvia Lebanon Lithuania Malaysia Mexico Moldova Mongolia Morocco Namibia Panama Peru Philippines Portugal Romania South Africa Sri Lanka Syria Tajikistan Thailand Tunisia Turkey Uruguay Venezuela Vietnam Zimbabwe

The strength of the cluster analysis is that it tries to be a politically useful tool by assisting the move toward a more analytically rigorous and data driven approach to environmental decision-making. The weakness of the cluster analysis is that it reduces complexity. In other words, political tool had been bought at the expense of simplification. Especially, the big clusters such as cluster 1 and 5 make one wonder how valuable will that exercise be for other countries than the industrialized ones. For example while rich countries might put great emphasis on reducing greenhouse gas emissions as the central element of sustainability, poor countries might provision of drinking water as their key challenge. So differences in values and assumptions about what matters most for a nation makes agreement on a single scale difficult. Fine-tuning that had been used for the small clusters is not adjustable for big clusters. The clusters are very uneven, in cluster 2 there are only 11 countries while in cluster 1 and 5 there are 51and 53 countries respectively.

The first two clusters have roughly similar scores on environmental systems and reducing stresses, but have different scores on vulnerability and capacity. These two groups are the two most divergent in terms of their socioeconomic conditions, institutions, and locations.

The first group is generally poor, vulnerable to corruption, undemocratic, and economically uncompetitive. The second cluster tends to show the opposite characteristics.

Comparing the second and third clusters, the main difference in terms of environmental sustainability measures is that the third group has markedly lower scores on environmental systems and stresses; the other scores are roughly similar. These two groups are quite similar in terms of socioeconomic conditions and institutions. The third group has generally higher population densities and significantly smaller average territory size.

In comparing the fourth and fifth groups, other differences come to the fore. Although the fourth group has slightly better vulnerability scores, it ranks lower in the other four categories and on the overall ESI average. Group four has especially low capacity scores, which can mean a weak ability to cope with unfolding environmental challenges. The main institutional difference between these groups is that group four is, on average, less democratic than group five.

2.3 Components of ESI

The ESI follows relative success for each country in five core components

- Environmental Systems
- Reducing Stresses
- Reducing Human Vulnerability
- Social and Institutional Capacity
- Global Stewardship

Each of these components reflects several factors. Each factor is measured by one or more variables, depending on the availability of comparable data across countries. The key design decision for the ESI was selection of the five components. The ESI team is stating that the way to achieve environmental sustainability is for a country to score well on these

By **environmental systems** component the current status of a nation's biophysical environment is represented. This component is consisting of five indicators: air quality, water quality, water quantity, biodiversity and land. This is the most straightforward of all the components. These factors are surely central in judging the condition of today's environment and in making predictions for the future.

Water quality had the greatest available data. For that the study team uses measures of the concentration of dissolved oxygen, suspended solids, phosphorus and electrical conductivity.

With the second component, **reducing stresses**, the threats posed to the environment by human activities are focused. This component involves both pollution and exploitation. It is aiming at measuring the efforts of a nation to lessen such stresses. This component contains five indicators: Reducing Air Pollution, Reducing Water Stress, Reducing Ecosystem Stress, Reducing Waste and Consumption Pressure, and Reducing Population Growth. The ESI team notes several problems with this component. One is that environmental stresses are hard to measure because they require a

lot of information and a broad understanding of interactive effects. Another is that this component can be over influenced geography.

By the third component, **reducing human vulnerability**, the interaction between humans and their environment, with a focus on how human‘s means of living are affected by environmental change is measured. This component comprised of two indicators: Basic Human Sustenance (food, sanitation, water) and Environmental Health.

The fourth component, **social and institutional capacity**, is the most critical one, since it involves the potential power of nation’s sustainability in how to understand and respond to revealing environmental dynamics. This component includes the indicators Science &Technology, Environmental governance, and Capacity for debate, Private sector responsiveness, and Eco-efficiency.

The ESI authors assemble diverse yardsticks to measure social and institutional capacity. For example, capacity for rigorous policy debate is measured by the number of environmental organizations in each country that are members of the World Conservation Union (IUCN).Environmental regulation and management is measured by the percent of land area under protected status, and the transparency and stability of environmental regulations. The transparency and stability data come from a survey conducted for the World Economic Forum's annual competitiveness report.

So-called public choice failures occur when governments make decisions for the benefit of special interests rather than the public interest. The ESI looks at three variables to measure such policy failures: low gasoline prices, fossil fuel subsidies, and the corruption perceptions index developed by Transparency International, a nongovernmental organization that promotes government accountability and opposes corrupt practices. The ESI team tried to find cross-country data on agriculture and fishing subsidies but was unsuccessful.

The final component, **global stewardship**, involves the global responsibilities of the country, this component is also critical because of the crucial sustainability element. This final component holds three indicators: Participation in international collaborative efforts, reducing greenhouse gas emissions and reducing transboundary environmental pressures.

2.4 ESI Component Values for Nordic Countries from 2000 to 2005

Pilot Environmental Sustainability Index Component Values 2000

Country	Environmental Sustainability Index	Environmental Systems	Environmental Stress& Risks	Human Vulnerability	Social And Institution Capacity
Denmark	71	70	65	99	64
Norway	76	89	68	98	63
Finland	75	82	75	93	64
Sweden	75	75	78	89	64

Environmental Sustainability Index Component Values 2001

Country	Environmental Sustainability Index	Environmental Systems	Environmental Stress& Risks	Human Vulnerability	Social And Institution Capacity
Denmark(7)	67	57	31	83	87
Norway(2)	78.2	87	52	82	85
Finland(1)	80.5	86	58	79	91
Sweden(5)	77.1	79	54	78	86

( ) MISSING VARIABLES

Environmental Sustainability Index Component Values 2002

Country	Environmental Sustainability Index	Environmental Systems	Environmental Stress& Risks	Human Vulnerability	Social And Institution Capacity
Denmark(4)	56.2	44	29	82	82
Norway (3)	73	78	58	85	86
Finland (0)	73.9	79	58	85	86
Sweden(3)	72.6	72	51	85	87

( ) MISSING VARIABLES

Environmental Sustainability Index Component Values 2005

Country	Environmental Sustainability Index	Environmental Systems	Environmental Stress& Risks	Human Vulnerability	Social And Institution Capacity
Denmark(0)	58.2	40	31	78	87
Norway(2)	73.4	82	48	78	91
Finland(1)	75.1	74	61	81	92
Sweden(1)	71.7	69	48	79	92

( ) MISSING VARIABLES

2.5 ESI Components and Denmark

ESI components consist of a number of indicators considered to constitute the most fundamental building blocks of each component. A total of twenty such *indicators* were identified. For each indicator, *variables* were identified to serve as measures.

In general, economies that rank high in environmental systems component have certain qualities: low population density, high wealth, or a bounty of natural resources such as water or biodiversity. This component appears to capture the extent to which environmental systems are maintained at healthy levels. In this component there are five indicators. (Air quality, water quality, water quantity, biodiversity and land) When it comes to Denmark with this component, it scores very low except biodiversity compared to other Nordic Countries. At the same time, it has a very high population density (see figure 2.5) and does not have many natural resources. From 2000 until 2005, in every ESI study, Denmark‘s decreasing score in this component can easily be observed.

Denmark is placed in cluster 3 because of its poor system and high stress factor while other Nordic countries are placed in cluster 2 with moderate system and moderate stress.

Country	**Population**	**area**
Finland	5,181,115 (2001)	338,145 km2
Sweden	8,882,792 (2001)	449,964 km2
Denmark	5,349,200 (2001)	43,094 km2
Norway	4,503,436 (2001)	323,877 km2

Figure 2.5

Denmark is also scoring very poorly in the Environmental Stress component in all years ESI study had been performed. Stresses are hard to measure, because conceptually they require knowledge of interaction effects. This component contains five indicators: Reducing Air Pollution, Reducing Water Stress, Reducing Ecosystem Stress, Reducing Waste and Consumption Pressure, and Reducing Population Growth. Reducing population growth is the only indicator that Denmark can keep up with other Nordic countries. Although Denmark, as a country will prefer to have a higher number of fertility rate than the current rate that it has. (1.75).This number is favourable for sustainable environmental goals, but not favourable for the country itself. With regards to air pollution, Denmark is less affected than the other Nordic countries. Thanks to the lime layers settled in Denmark's underground; acidification of lakes and forests is limited and Denmark is, due to reliance on coal for energy supply, itself a net exporter of air pollution (Andersen, 1997p:271).

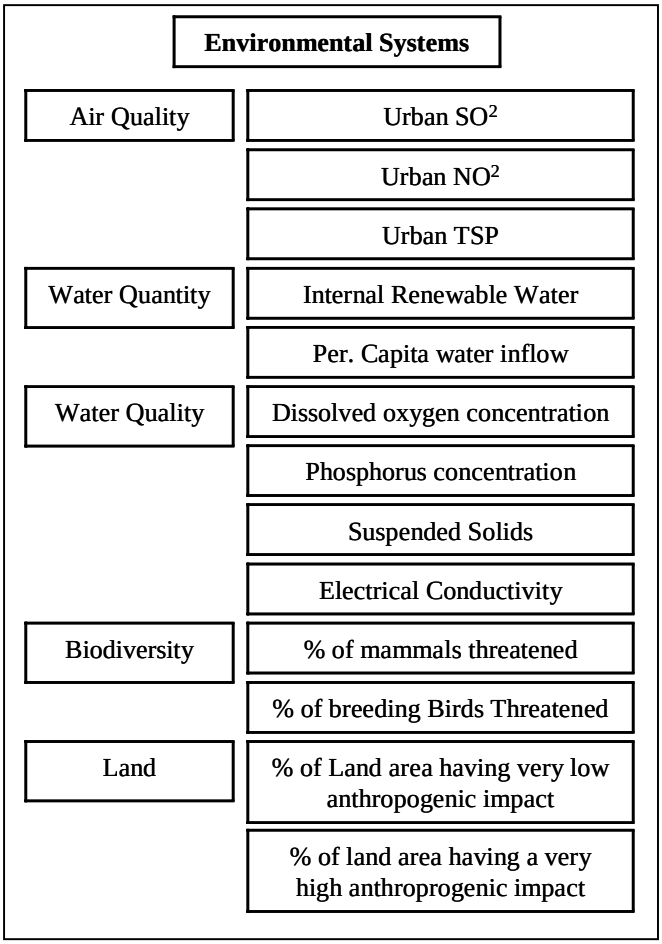
CHAPTER3
ESI 2002

3.1 ESI Indicators in detail

The Environmental Sustainability Index (ESI) measures overall progress toward environmental sustainability for 142 countries. In the architecture of the ESI, all indicator scores are calculated in relative terms and then averaged to generate the composite scores. This presumes that the countries are fundamentally comparable. ESI assumes that the significance of a very low or a very high score for any one variable comparable across countries, and that it relates directly to practical concerns for environmental sustainability in each country

In ESI equal weighting is used across the 20 indicators instead of putting special emphasis on special issues or indicators. The main reason for this choice is that “environment” refers to a wide range of issues including air and water pollution, waste management, toxic exposures, as well as range of natural resource management issues. And equal weighing reflects this balance of environmental issues that countries across the world must address.

Environmental sustainability is measured through 20 “indicators,” each of which combines two to eight variables, for a total of 68 underlying data sets. All those variables had been grouped under each indicator. Each indicator had been analyzed and compared by Nordic countries performance scores.



3.1.1 Air Quality

Both the natural ecosystem and human health can be adversely impacted by declining air quality and climatic change. Communities can preserve air quality by limiting or eliminating the discharge of harmful chemicals into the air and by minimizing the sources of air pollution.

Urban SO2, N02, TSP is an indicator of urban air quality. The unit for this variable is micrograms/m3. (World Bank, 2000)

Variable name	Denmark	Norway	Finland	Sweden
Urban SO2 concentration	7.00	5.47	4.38	5.23
Urban NO2 concentration	54.00	49.65	30.69	29.68
Urban TSP concentration	61.00	10.25	49.90	9.00

3.1.2 Water quantity

The per capita volume of internal renewable water resources in a country is important for a variety of environmental services and to support the needs of the population.

This variable measures internal renewable water (average annual surface runoff and groundwater recharge generated from endogenous precipitation, taking into account evaporation from lakes and wetlands) per capita.

The sum of per capita internal water availability and the per capita volume of water flowing into a country provide a more complete assessment of a country's water resources, which are important for a variety of environmental services and to support the needs of the population.

Variable name	Denmark	Norway	Finland	Sweden
Internal renewable water per capita	2.49	57.71	18.01	15.91
Per capita water inflow from other countries	0.00	2.53	2.35	0.91

Centre for Environmental Systems Research, University of Kassel, Water GAP 2.1B,

3.1.3 Water quality

This variable is a measure of eutrophication, which has an important impact on the health of aquatic resources and ecosystems. High levels of dissolved oxygen correspond to low eutrophication. (UNEP)

Phosphorous concentration is a measure of eutrophication, which affects aquatic resources health. High levels of Phosphorous correspond to high eutrophication.(UNEP) Excessive nutrient loading fertilizes fresh water and coastal ecosystems can cause eutrophication. While small increases in nutrient loading often cause little change in many ecosystems, once a threshold of nutrient loading is achieved, the changes can be abrupt and extensive, creating harmful algal blooms (including blooms of toxic species) and often leading to the domination of the ecosystem by one or a few species. Severe nutrient overloading can lead to the formation of oxygen depleted zones, killing all animal life. (MEA, 2005)

A suspended solid is a measure of water quality and turbidity.

Electrical conductivity is a widely used bulk measure of metals concentration and salinity. High levels of conductivity correspond to high concentrations. *(*UNEP)

Variable name	Denmark	Norway	Finland	Sweden
Dissolved oxygen concentration	10.00	11.19	11.19	9.27
Phosphorous concentration	0.14	0.01	0.01	0.28
Suspended solids	2.62	3.02	1.17	2.47
Electrical conductivity	422.19	0.61	50.49	77.56

3.1.4 Biodiversity

Biodiversity is particularly important for creating sustainability because of the specialized roles each species plays in maintaining ecological balance. Communities can promote healthy wildlife by supporting integrative approaches for managing, protecting, and enhancing wildlife populations and habitats appropriate to their area.

The ESI biodiversity indicator is composed of two variables describing the number of known species that are endangered or threatened in two categories of species for which data is available. Both measures derive from the IUCN "Red List".[1] A threatened species is one that has become rarer and could face extinction if trends are not reversed.

The percent of threatened mammals and breeding birds threatened gives an estimate of a country's success at preserving its biodiversity. Number of mammal species threatened divided by known mammal species in the country gives the percentage value. The percentage is measured by dividing the number of bird species threatened by known bird species in the country. According to Copenhagen Post published on 31st of March, Denmark's wildlife is in danger, as one out of four of the country's 30,000 flora and fauna species has disappeared or is more or less threatened with extinction, a new study finds.

A new survey released by the National Environmental Research Institute sampled 2,209 species of fungi, insects, spiders and birds to compile a so-called `red list' of species in critical condition. The list provides an overview of plants and animals at risk of extinction.
Researchers found that 558 species had disappeared or were more or less endangered. Of these, 66 species had disappeared since 1850.

The reasons for the species' decline could be attributed to habitat destruction. The species most affected often live isolated in small groups. At the same time, air pollution and changes in agriculture and forestry pose an increasing threat to wildlife.

Variable name	Denmark	Norway	Finland	Sweden
Percentage of mammals threatened	11.63	18.52	10.00	13.33
Percentage of breeding birds threatened	0.51	0.82	1.21	0.80

[1] The IUCN Red List is the world's most comprehensive inventory of the global conservation status of plants and animals.

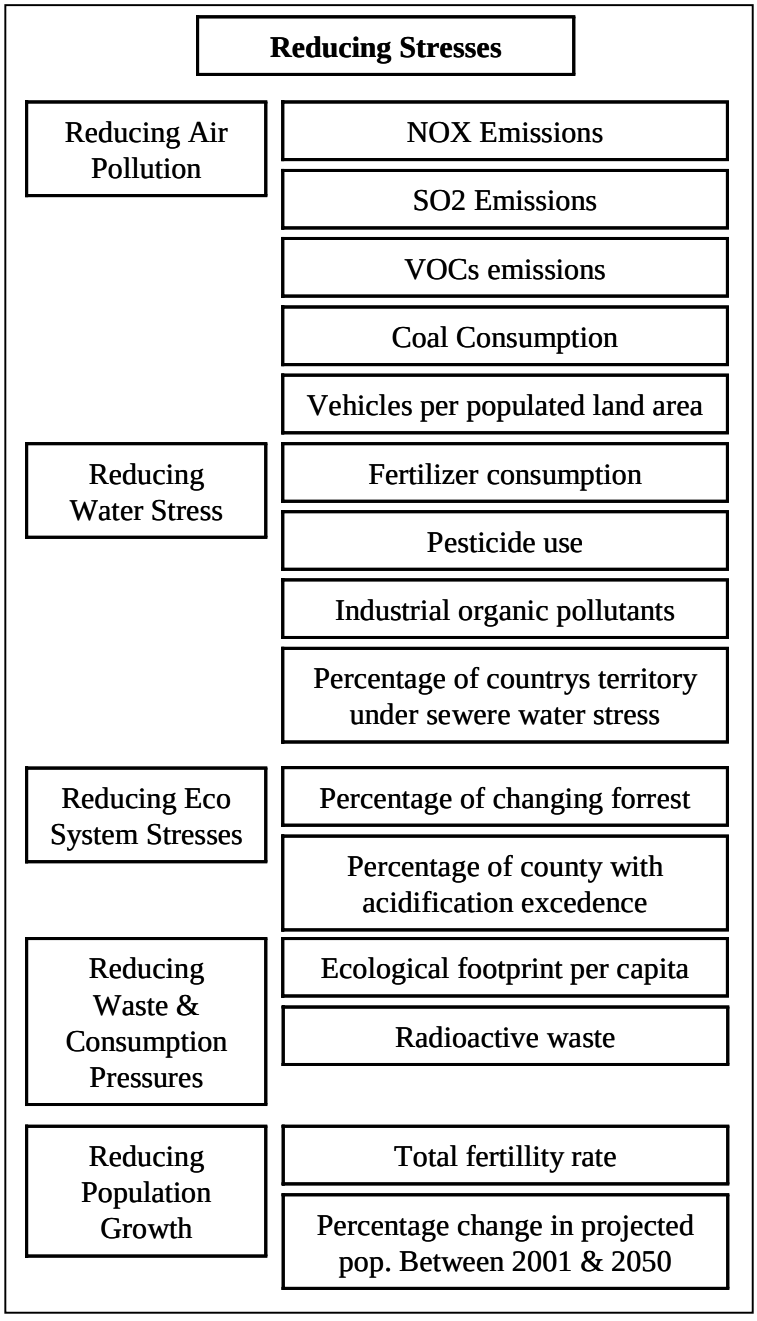
3.1.5 Land

Agricultural activities and the built environment have high impacts on the natural environment. The conversion of natural vegetation for anthropogenic activity has important ecological implications. Percent of land area with very low anthropogenic impact is measured. The higher the percent area untouched better it is for sustainable environment. Also percent of land area having very high anthropogenic impact is calculated. In this second variable, lower percent area represents lower stress on environment so it is more favourable to have a lower number from sustainability point.

On the other hand, there is a critique for this indicator. According to the Reed and Dougill, (2001) p: 230, this indicator has been simplified to an extent that it cannot usefully inform land management decisions

The population density of Denmark is very high compared to other Nordic countries. It‘s area is the smallest while it’s population is high compared to its area. This can be seen in the figure 1 .So this just by its nature puts more stress on environment. Norwegians have traditionally attached value to ‘untouched nature’. (Andersen & Lieffferink eds., 1997 p.p 289).This value can be observed with the high percent of land area with a very low anthropogenic impact.

Variable name	Denmark	Norway	Finland	Sweden
Percent of land area having very low anthropogenic impact	0.00	28.71	30.04	31.41
Percent of land area having high anthropogenic impact	39.45	3.89	3.70	7.48


Reducing Stresses
Reducing Air Pollution
NOX Emissions
SO2 Emissions
VOCs emissions
Coal Consumption
Vehicles per populated land area
Reducing Water Stress
Fertilizer consumption
Pesticide use
Industrial organic pollutants
Percentage of countrys territory under sewere water stress
Reducing Eco System Stresses
Percentage of changing forrest
Percentage of county with acidification excedence
Reducing Waste & Consumption Pressures
Ecological footprint per capita
Radioactive waste
Reducing Population Growth
Total fertillity rate
Percentage change in projected pop. Between 2001 & 2050

3.1.6 Reducing Air pollution

NOx emissions affect both ecological resources and human health.SO2 and NOx are among the anthropogenic pollutants that contribute to acid rain and affect forests, soil, and aquatic habitats, as well as the main determinants of air quality.SO2 and N0x are produced mainly by industrial activities and fossil fuel combustion. VOC (non-methane volatile organic compounds) emissions derive mainly from the incomplete combustion of fuels or the evaporation of fuels, lubricants, and solvents. This contributes mainly to photochemical smog.

Vehicles per populated land area are a proxy measure of air pollution from the transportation sector, which is the fastest growing sector in terms of energy use. Vehicles per populated land area are calculated. Denmark has the highest vehicle density due to its small area. (Figure2.5)

Coal fired power plants emit higher levels of SO2 and other air pollutants than natural gas or oil fired plants, and the energy produced is more carbon-intensive. Denmark relies highly on coal for Energy supply. (Table 3) Most air emissions stem from power plants, which are organized into two regional monopolies. In 1984, the government reached an agreement with the management of those monopolies for a substantial reduction in air pollution, within the framework of quotas allocated within a national air pollution control 'bubble'. So air pollution has not been an issue to the same extent as other Nordic countries. (Andersen, 1997pp:262.)Denmark's energy mix consists of 75% coal, 10% natural gas, 3% oil and 1.2 % wind energy.
(The rest of the energy sources can be seen on appendix C)

Recently, Denmark rejected E.U directive on biofuel and stated that it has no intention of replacing petrol and diesel oil with bio fuel according to Copenhagen Post's report. The directive instructs member countries of the European Union to replace 2 percent of petrol and diesel oil for transport with liquid biofuel in 2005.Biofuel is not considered to add to greenhouse gasses in the atmosphere.

Denmark was the only member country to answer the EU that it would not increase its share of biofuel transport. (Jyllands posten, May 2005). Currently Biogas is only taking 0.2 % of the total energy share. (Table 3)

Variable name	Denmark	Norway	Finland	Sweden
SO2 emissions per populated area	2.86	0.35	1.48	0.77
VOCs emissions per populated land area	4.45	0.76	0.47	0.68
NOx emissions per populated land area	54.88	15.69	0.19	0.27
Vehicles per populated land area	50.91	19.42	15.67	18.84
Coal consumption per populated land area	4.69	0.38	0.95	0.40

3.1.6 Reducing water stress

Excessive use of fertilizers from agricultural activities has a negative impact on soil and water, altering chemistry and levels of nutrients and leading to eutrophication problems. Fertilizer consumption per hectare of arable land is analyzed. Higher amount of fertilizer consumption shows more stress for soil and water environment. In Norway, the regulations are carried out through directives based on the Pollution Control Act and supported by 'soft' means, such as guidelines and technical advice available to farmers. The farmers in Norway are subsidized.
(Andersen & Lieffferink eds., 1997 pp:293).

Excessive use of pesticides in agricultural activities has a negative impact on soil, water, humans and wildlife. Pesticide use is calculated by using the units Kg/Hectare of Cropland. Denmark uses highest amount of pesticide. Although, Fox states in his article in journal of applied ecology pesticide and inorganic fertilizer use has declined and organic farming has expanded in Denmark since 1983. Environmental taxes in the agriculture sector focused primarily on pesticides, fertiliser and manure wastes. Denmark, Norway and Sweden had all introduced taxes on pesticide use as stated on university of Essex's webpage. (CES, 1998)

The regional distribution of water availability relative to population and consumption needs is as important as its overall water availability. This variable captures the percent of the territory that is under water stress, which will affect the availability of water for environmental services and human well-being. Higher percentage indicates more stress on water resources.

Denmark has the highest percentage with water stress territory compared to other Nordic countries. Low stress 10 to < 20%; threshold values/ranges for the water exploitation index have been used to indicate levels of water stress. Also according to the water exploitation index on European Environment Agency's webpage Denmark is considered as having low water stress. The water exploitation index (WEI) in a country is the mean annual total demand for freshwater divided by the long-term average freshwater resources. It gives an indication of how the total water demand puts pressure on the water resource. (EEA, 2003)

Emissions of organic pollutants from industrial activities cause water quality degradation. Emissions of organic water pollutants are measured by biochemical oxygen demand, which refers to the amount of oxygen that bacteria in water will consume in breaking down waste. The base-10 logarithm of this variable is used when metric tons of BOD emissions per cubic km of water are calculated.

Variable name	Denmark	Norway	Finland	Sweden
Fertilizer consumption per hectare of arable land	1704.2	2257.71	1407.48	1006.47
Pesticide use per hectare of cropland	2200.00	941.00	410.00	509.00
Industrial organic pollutants per available freshwater	7.13	0.20	0.61	0.62
Percentage of country's territory under severe water stress	7.70	0.40	2.10	0.60

3.1.7 Reducing ecosystem stress

While providing a protective covering for soil, water, and the atmosphere, forests are also renewable sources of an endless variety of products. In a healthy ecosystem, policies and programs must balance economic and conservation needs.

When forests are lost or severely degraded, their capacity to function as regulators for the environment is also lost, increasing flood and erosion hazards, reducing soil fertility, and contributing to the loss of plant and animal life. As a result, the sustainable supply of goods and services from forests is put into risk. Percent Change in forest cover is measured. The bigger the percentage, more of the regulative functions of the forests are obtained.

According to Food and agriculture organization of the United Nations (FAO) forestry official webpage, during the last 200 years the forest area has increased from only a few percent of the Danish land to its present more than 10 percent. Furthermore, the last 10 to 20 years in addition to timber production the forests are also expected to provide public recreation, and nature and landscape amenity. In order to meet these new demands, considerable efforts have been undertaken to adjust forest development. A project aiming at "Green Forest Management" has been implemented in the state forests focusing on protection of forest nature and sustainable forest management. An important objective in Danish forest policy is to double the forest area within one tree generation (80-100 years). Statistics are indicating that the forest area is increasing.

Especially in this variable, the governance factor in shaping environmental sustainability is critical.

Exceedance of critical SO2 loading represents an indicator for ecosystems under stress due to acidification from anthropogenic sulphur deposition. Since it takes into account both the deposition and the ability of the ecosystem to respond to stress, it is a good indicator of the ecosystems' "sustainability". Percent of Land Area under stress due to S02 loading is measured. Higher percentage shows higher stress. Denmark is scoring very high compared to other Nordic countries.

Variable name	Denmark	Norway	Finland	Sweden
Percentage change in forest cover 1990-2000	0.20	0.40	0.00	0.00
Percentage of country with acidification exceedance	54.88	15.96	1.19	34.37

3.1.8 Reducing waste consumption pressures

The ecological footprint is a measure of the biologically productive land that is required to sustain a country's population at current consumption levels. The footprints, as calculated by Redefining Progress (Wackernagel et al, 2001) compare consumption of natural resources in each country with the biosphere’s ecological capacity.

The ecological footprint also reflects population size, average consumption per person and the resource intensity of the technology used. The unit for this variable is hectares per person. Denmark has a higher demand of biologically productive soil to sustain its current consumption pattern.

Radioactive waste, as a source of ionizing radiation, has long been recognized as a potential hazard to human health. Many practices in the fields of research, medicine, industry and generation of electricity generate waste that requires management to ensure the protection of human health and the environment now and in the future.
(The Principle of Radioactive Waste Management, IAEA, 1997).

The minimum value for this variable is -0.36 for all countries. Sweden has a higher value than other Nordic countries which is parallel with the Swedish choice for alternative energy.

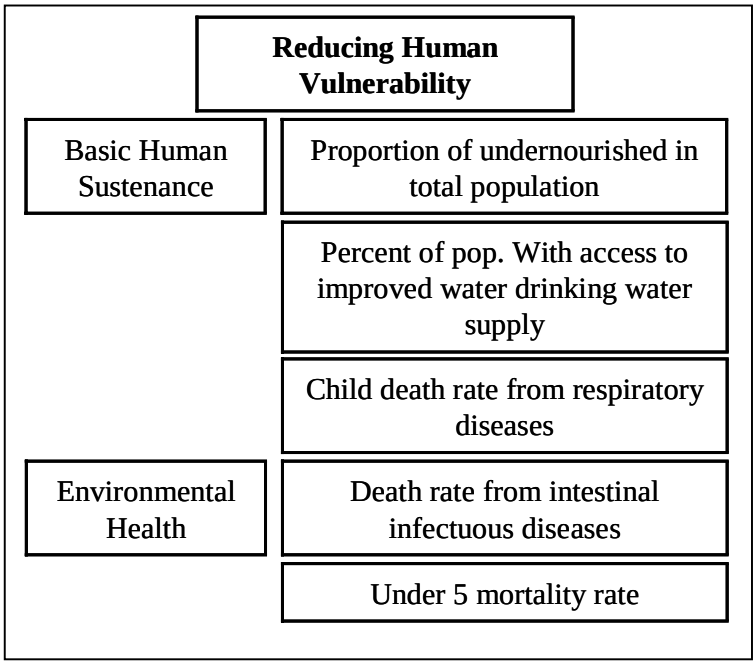
Variable name	Denmark	Norway	Finland	Sweden
Ecological footprint per capita	9.88	6.13	8.45	7.53
Radioactive waste	-0.35	-0.35	-0.34	-0.23

3.1.9 Reducing population growth

Fertility contributes significantly to population growth, and thus to pressure on natural resources. If fertility remains at high levels indefinitely, it is environmentally unsustainable. Unit for this variable is average number of births per woman. (PRB, 2001)

The projected change in population between 2000 and 2050 provides an indication of the trajectory of population change, which has an impact on a country's per capita natural resource availability and environmental conditions. This variable got a critique. According to that critique a future (projected) rate of growth can not reduce present environmental stress. (Charnovitz, 2000 p: 12)

Variable name	Denmark	Norway	Finland	Sweden
Total fertility rate	1.75	1.84	1.72	1.53
Percentage change in projected population between 2001 & 2050	16.50	15.46	-7.83	7.37



3.1.10 Basic human sustenance

This indicator represents a measure of the population vulnerability to malnutrition, famine or diseases, in addition to showing the incapacity of an economy to supply an adequate amount of food and to manage food resources (FAO, 2000) .The unit for this variable is percentage of total population. The critique for that variable states 'proportion of under-nourished in total population' cannot be related directly to environmental degradation. (Charnovitz, 2000 p: 14)

The percentage of population with access to improved sources of drinking water supply is directly related to the capacity of a country to provide a healthy environment, reducing the risks associated with water-borne diseases and exposure to pollutants. (WHO, 2000) The unit for this variable is percentage of total population.

According to critiques, this indicator has a serious lapse relating to the code of the variables. In order to clarify what it meant with the code of variables:

For instance, in the core indicator 'Basic Human Sustenance' two variables are included:

(i) Proportion of under-nourished in total population

(ii)Percentage of population with access to improved drinking water

The problem with the 'code' is that if the index is low it favours the former variable and if it is high it favours the latter.

The first and foremost principle in formation of an index is that the sum total of the variable must yield an interpretation that is unidirectional. That is, the 'code' must be the same. Once the index is aggregated such differences would not be known to the users but would have serious implications for analysis. (Jha &Murty, 2003) If the magnitude of under nourishment were low it would go in favour of 'Basic Human Sustenance'. On the other hand, with the second variable if the magnitude were high it would go in favour of 'Basic Human Sustenance'.When those two variables are combined then it will be problematic to interpret the index. If a country has high values for both under nourishment and drinking water, then this result can not be treated as being favourable for 'Basic Human Sustenance'.

Variable name	Denmark	Norway	Finland	Sweden
Proportion of undernourished total population	1	1	1	1
%of population with access to improved drinking H20 supply	100	100	100	100

3.1.11 Environmental Health

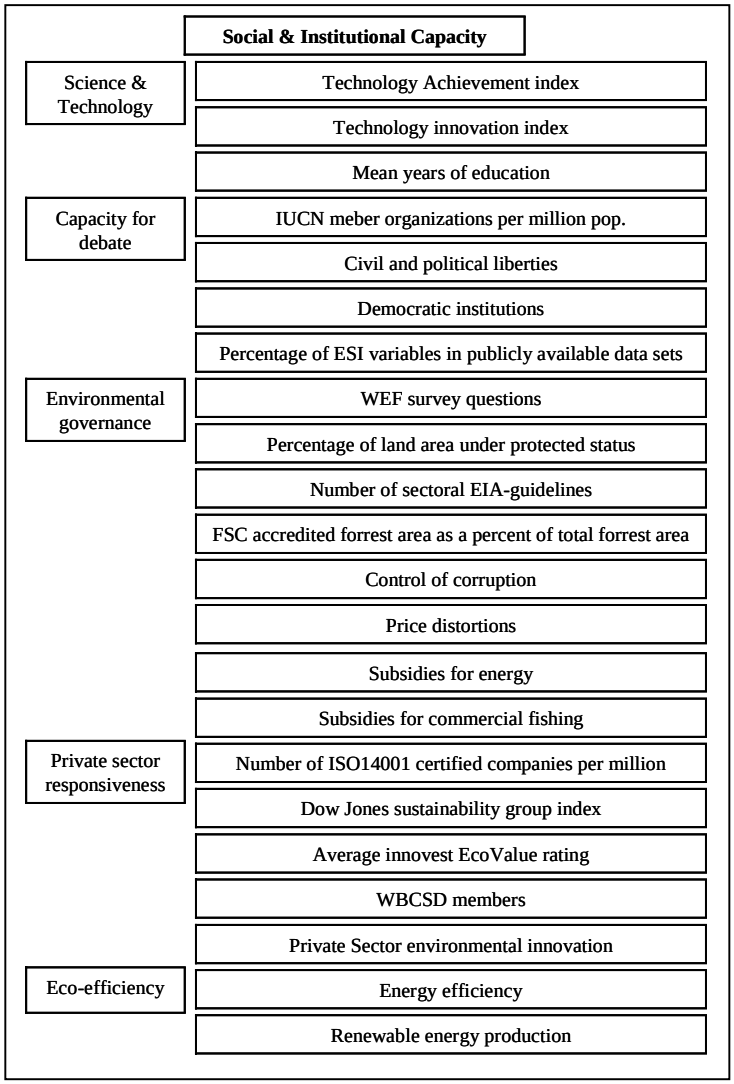
The respiratory disease death rates are calculated only for children because among adults lifestyle and occupational factors play a major role in mortality rates, whereas among children environmental effects predominate. The unit for this variable is deaths/100,000

Population Aged 0-14.

This variable indicates the degree to which the population is affected by poor sanitation and water quality related to environmental conditions. The unit for this variable is deaths/100,000 Population. World Health Statistics Annual is used. Environmental conditions especially water quality play a major role among all age groups in intestinal infectious diseases.

The under –five mortality rate is used because children under five are generally more susceptible to water-borne and respiratory diseases. So this can contribute to higher mortality rates in countries while water and air quality are poor. The unit for this variable is deaths per 1,000 live births.

Variable name	Denmark	Norway	Finland	Sweden
Child death rate from respiratory diseases	15.14	0.24	0.41	1.03
Death rate from intestinal infectious diseases	7.86	1.33	0.97	0.39
Under 5 mortality rate	5	4	5	4



3.1.12 Science /Technology

The higher a country's technology achievement index score, the greater its ability to create technological solutions to environmental problems. Denmark did not have any value for its technology achievement index in ESI. Norway scores on the twelfth Sweden on the third and Finland scores on the first rank. (HDR, 2001)

This index measures the underlying capacity of a country to engage in technological innovation by examining factors such as scientific infrastructure and policy environment.

The development and diffusion of scientific knowledge and technologies that exploit that knowledge has profound implications for ecological systems and human well-being. The twentieth century saw tremendous advances in understanding how the world works physically, chemically, biologically, and socially and in the applications of that knowledge to human endeavours. The impact of science and technology on ecosystem services is most evident in the case of food production. (MEA 2005)

Much of the increase in agricultural output over the past 40 years has come from an increase in yields per hectare rather than an expansion of area under cultivation. For instance, wheat yields rose 208%, rice yields rose 109%, and maize yields rose 157%in the past 40 years in developing countries. At the same time, technological advances can also lead to the degradation of ecosystem services. Advances in fishing technologies, for example, have contributed significantly to the depletion of marine fish stocks.

The more educated a population is, the more likely it is to have the ingenuity to develop sustainable solutions to environment and development challenges. (UNDP,2001)

Variable name	Denmark	Norway	Finland	Sweden
Technology achievement index	-------	0.58	0.74	0.70
Innovation index	25.20	25.30	29.10	26.90
Mean years of schooling (age 15 and above)	9.70	11.90	10.00	11.40

3.1.13 Capacity debate

IUCN is the oldest international environmental membership organization, currently it has 900 members (governmental and NGO) worldwide, so it includes the most significant NGOs in each country. The unit for this variable is organizations/million population. Sweden is scoring higher than the other countries when the population is taken into consideration.

In countries that guarantee freedom of expression, rights to organize, rule of law, economic rights, and multi-party elections, there is more likely to be a vigorous public debate about values and issues relevant to environmental quality. Index is ranged from high levels of liberties (1) to low levels of liberties (7)

The presence of democratic institutions increases the likelihood that important environmental issues will be debated, that alternative views will be aired, and that decision-making and implementation will be carried out in an open manner. Scale is ranged from - 10 (autocratic) to +10 (democratic)

The greater the number of missing variables in ESI shows poorer data availability in that country. Environmental monitoring and data systems are vital for tracking progress towards environmental sustainability and decision making.

Variable name	**Denmark**	**Norway**	**Finland**	**Sweden**
IUCN member organizations per million population	1.31	1.33	0.96	0.79
Civil & political liberties	1	1	1	1
Democratic institutions	10	10	10	10
Percentage of ESI variables in publicly available data sets	5	2	0	4

3.1.14 Eco efficiency

Communities require energy. Non-renewable sources for power generation, home and workplace, and transportation cause pollution and its harmful impacts. Energy conservation and the use of renewable fuels provide cost-effective and more sustainable alternatives

The more efficient an economy is, the less energy it needs to produce goods and services. Countries vary considerably in how efficiently they use natural resources in order to produce the goods and services consumed locally or exported. Eco efficiency indicator measures the amount of energy consumed per unit of GDP and the degree to which an economy relies on renewable sources of energy. *(*EIA, 2005)

The higher the proportion of hydroelectric and renewable energy sources, the less reliance will be on more environmentally damaging sources such as fossil fuel and nuclear energy. The unit for this measure is renewable energy production as a percent of total energy.
(Hydroelectric, biomass, geothermal, solar and wind electric power production as a percentage of total energy consumption.) (EIA, 2005)

Variable name	Denmark	Norway	Finland	Sweden
Energy efficiency(total energy consumption per unit GDP)	6.42	14.90	10.99	10.98
Renewable energy production As a percentage of total energy consumption	5.13	66.18	17.61	33.95

3.1.15 Environmental Governance

Environmental governance is defined as the institutions, rules and practises that shape responses to environmental challenges. Effective governance is vital for environmental sustainability.

The unit for regulatory rigor is survey responses ranging from 1 (strongly disagree) to 7.With this survey, the quality of environmental regulations is measured. In WEF(World Economic Forum) survey questions mainly aspects of environmental governance: air pollution regulations, chemical waste regulations, clarity and stability of regulations, flexibility of regulations, environmental regulatory innovation, leadership in environmental policy, stringency of environmental regulations, consistency of regulation enforcement, environmental regulatory stringency, toxic waste disposal regulations, and water pollution regulations are touched. The World Economic Forum (WEF) is an independent, non-for-profit organization bringing together top leaders from business, government, academia and the media to address key economic, social and political issues in partnership.

The WEF conducts the Global Competitiveness Survey of about 3000 enterprises in 60 countries every year. This survey measures the perceptions of business executives about the country in which they operate. The survey asks top managers to rank on a 1 to 7 scale their opinion on issues in eight broad areas: 1) Openness, 2) Government, 3) Finance, 4) Infrastructure, 5) Technology, 6) Management, 7) Labour, and 8) Institutions.

Name of the index	Denmark	Norway	Sweden	Finland
Growth competitiveness index rank	5	6	3	1
Business competitiveness index rank	7	20	4	2
Technology index rank	6	10	4	3
Public institutions index rank	1	5	21	3
Macroeconomic environment index rank	4	2	15	3

Source :(Reeves, 2005)

The percentage of land area dedicated to protected areas represents an investment by the country in biodiversity conservation. (UNEP, 2004)(It can be seen in appendix E)

This variable measures the extent to which an economy seeks sustainable forestry practices. (FSC, 2005)

Environmental Impact Assessment sectoral guidelines mandated by national governments are an important prerequisite for sound environmental management. Environmental assessment is a procedure that ensures that the environmental implications of decisions are taken into account before the decisions are made. The process involves an analysis of the likely effects on the environment, recording those effects in a report, undertaking a public consultation exercise on the report, taking into account the comments and the report when making the final decision and informing the public about that decision afterwards. (E.U, 2005)

In principle, environmental assessment can be undertaken for individual projects such as a dam, motorway, airport or factory or for plans, programs and policies.

In ESI, the selected criteria for measuring environmental management are number of guidelines in EIA. According to that criterion, Finland has 5, Sweden has 3, Denmark has 1 guidelines and Norway has none. While in Malaysia there are 13 guidelines which is the maximum.

There had been a workshop on the Nordic EIA effectiveness in 1994.The objective of that workshop was to compose Nordic experience about EIA effectiveness in order to form a basis for future EIA evaluation and general development of EIA methods and practises in the Nordic countries. (Hilden&Laitinen, 1995)The conduct and effectiveness of EIA practise can be seen as a reflection of he laws, policies and arrangements that are established in institutional frameworks of different Nordic countries.

In Norway, EIA system is introduced in 1990, in Denmark in 1989, in Finland, in 1991. For Sweden, it was 1987 the regulations about EIA were put into the environmental protection act and in 1991 EIA regulations are introduced into Natural Resources Act. In Norway, public participation observed was not as strong as the other Nordic countries. In Denmark also in order to increase the reliability of EIA procedure, it is suggested that the public should take more part in the creation of politics (Elling, 1994) Although, in Denmark, the authorities are obliged to call for proposals and ideas from the public concerning the scope of the assessment and they are obliged to arrange public hearings, still public participation is not at the desired level.

In Sweden, EIA process takes many years. The general public has almost no possibility to influence the contents of the document until the last stage of the process. In Denmark, the county councils which are independent political authorities between state and municipalities are responsible for the physical planning in EIA.

Corruption contributes to lax enforcement of environmental regulations and an ability on the part of producers and consumers to evade responsibility for the environmental harms they cause.
(Koffmann et al, 2000)The Nordic countries are the least corrupted states in the world, according to the Corruption Perception Index which is published annually by Transparency International. Finland, Denmark, Iceland, Sweden and Norway figure as the top countries on the TI index because of their high levels of freedom of speech, open administration, transparency in political institutions, and consensual political system which emphasizes common problem solving. (Scandinavica, 2005) The conclusion from TI's research is that corruption in public administration and economy is less likely to flourish in well governed countries such as in Scandinavia than in poor nations.

Moreover, the less corrupt countries in the world happen to be the most environmentally friendly countries according to the Human Development Report which is published annually by the United Nations. So for Nordic countries, this variable is not a distinguishing factor from governance point of view.

Taxes and subsidies are important indirect drivers of ecosystem change. Fertilizer taxes or taxes on excess nutrients, for example, provide an incentive to increase the efficiency of the use of fertilizer applied to crops and thereby reduce negative externalities. Currently, many subsidies substantially increase rates of resource consumption and increase negative externalities. Annual subsidies to conventional energy, which encourage greater use of fossil fuels and consequently emissions of greenhouse gases are estimated to have been $250–300 billion in the mid-1990s. The 2001–03 average subsidies paid to the agricultural sectors of OECD countries were over $324 billion annually , encouraging greater food production and associated water consumption and nutrient and pesticide release and reduced the profitability of agriculture in developing countries. At the same time, many developing countries also have significant agricultural production subsidies.
(MEA, 2005)

The Danish state hands DKK 10 billion to Danish companies, placing Denmark at the top of the EU list of state support of national companies, daily newspaper Politiken reported on 18th April 2005. In its last report, the European Commission estimated state subsidies at 0.72 percent of the Danish gross national product, excluding subsidies to agriculture, fisheries, or transport. OECD has raised the alarm on Denmark's high subsidies and pointed out that the country has repeatedly been found guilty of illegal support. (Jylandsposten, April2005)

Unsubsidized gasoline prices are an indicator that appropriate price signals are being sent and that environmental externalities have been internalized. High taxes on gasoline act as an incentive for public transportation use and development of alternative fuels. The unit for this measure is the ratio of gasoline price to world average. (GTZ, 1999)

Subsidies can encourage wasteful consumption of energy and materials. Many governments actively seek to conceal subsidies including credit support programmes, tax preferences, insurance support, capital & infrastructure supports and marketing &price supports.(Porter,2001) The unit for this measure is survey responses ranging from 1 (strongly disagree) to 7.

Subsidies to the fishing industry encourage over-capacity, and therefore over-fishing. So the bigger the amount of subsidy, it is worse for the sustainability. (WWF technical paper, 2001)

Variable name	Denmark	Norway	Finland	Sweden
Regulatory rigor	1.56	1.26	2.08	1.77
Percentage of land area under protected status	23.96	6.25	8.42	8.28
Number of sectoral EIA guidelines	1	---	5	3
FSC accredited forest area as percentage of total forest area	0.09	0.06	0.00	33.97
Control of corruption	2.13	1.69	2.08	2.09
Reducing market externalities(ratio of gasoline price to international average	1.66	1.21	1.74	1.54
Subsidies for energy or materials usage	4.96	4.55	5.94	5.38
Subsidies to the commercial fishing sector	60.65	160.40	24.50	43.20

3.1.16 Private sector responsiveness

In the 1990's there has been a growing awareness that public/private partnerships can benefit sustainable community development. Local governments can cooperate with for-profit and non-profit institutions to develop sustainability initiatives. (SCN, 2005)

According to critiques, this indicator has a corporate bias. It is biased towards industry against agriculture/forest. It is biased towards corporate governance against people's governance.
(Jha, R &Murty, K. 2003)

ISO 14001 specifies standards for environmental management. The more firms that receive ISO

14001certification, the more likely it is that industries are instituting management practices that reduce waste and resource consumption. Unit for this variable is number of ISO 14001 certified companies/GDP in US. (See table in appendix F)

The Dow Jones Sustainability Group Index tracks a group of companies that have been rated as the top 10% in terms of sustainability. Firms that are already in the Dow Jones Global Index are eligible to enter the Sustainability Group Index. Countries in which a higher percentage of eligible firms meet the requirements have a private sector that is contributing more strongly to environmental sustainability. In order to measure the group index for each country, the number of companies in the Sustainability Index was divided by the number of companies in the Global Index.[2] . (See appendix G)

The Innnovest EcoValue '21 rating measures environmental performance at the firm level. The unit is ranged from 1 (Worst) to 7 (Best).

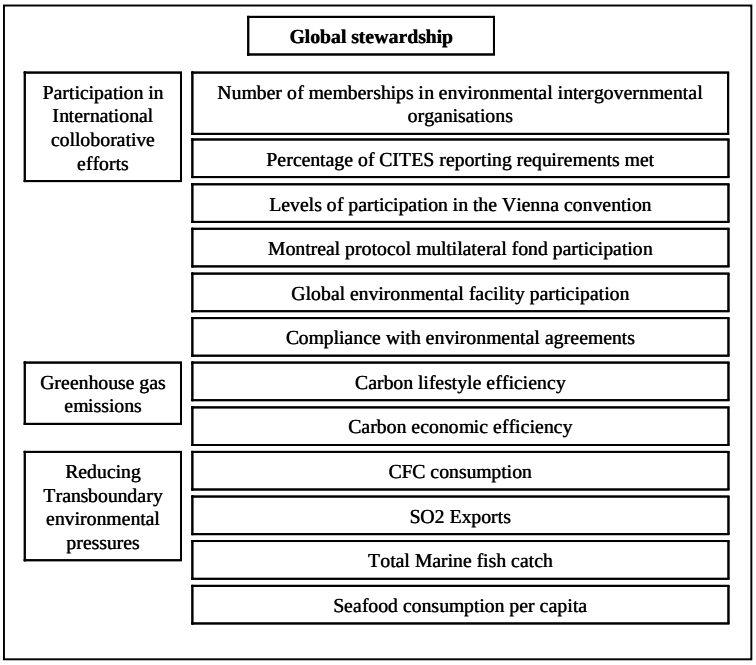
The data from innovest's eco value rating and sustainability asset management and Dow Jones sustainability group index provide information with remarkable depth concerning the extent and the effectiveness of environmental management at the corporate level and shed useful light on national differences.

World Business Council on Sustainable Development is a prominent private-sector organization promoting the principles of sustainable development and encouraging high standards of environmental management within firms. Unit for this variable is members per billion dollars GDP. (The member Nordic companies can be seen in appendix H)

[2] "Assessment of the Country Allocation of the Dow Jones Sustainability Group Index", SAM Sustainability Group

Private sector innovation contributes to solutions to environmental problems. This variable represents the principal component of responses to several WEF survey questions. It touches on several aspects of private sector environmental innovation: environmental competitiveness, prevalence of environmental management systems, and private sector cooperation with government.

Variable name	Denmark	Norway	Finland	Sweden
Number of ISO14001 certified companies per million $ GDP	64.32	23.48	54.67	101.23
Dow Jones Sustainability Group Index	33.10	33.10	84.90	56.60
Average innovest Ecovalue rating of firms	3.96	6.14	6.77	5.67
World business council for sustainable development members	22.33	48.59	35.27	10.52
Private sector environmental innovation	0.75	0.82	2.63	1.90



3.1.17 Participation in International Collaborative efforts

Countries contribute to global environmental governance by participating in intergovernmental environmental organizations. In ESI, 100 intergovernmental organizations are coded as environmental.

Preparing and submitting national reports is a fundamental responsibility under CITES. The degree to which a country fulfils this responsibility is an indication of how seriously it takes its commitment to protection of endangered species. Sweden has the highest percent of requirements met.

The number of protocols and amendments that a country has acceded to or ratified under the Vienna Convention is an indication of its commitment to fight ozone depletion. Countries received a score of zero if they were not signatory to the Vienna Convention.

They received a score of 1 if they had ratified the Montreal Protocol only. They received a score of 2 if they ratified the above plus the London Amendment. They received a score of 2.5 if they ratified the above plus the Copenhagen Amendment. They received a score of 3 if they ratified the above plus the Montreal Amendment. (UNEP, 2005)

Managing global environmental problems requires active financial participation, both among donors and recipients. The Montreal Protocol Multilateral Fund is a major organized effort to finance reductions in production and consumption of ozone-depleting substances

Managing global environmental problems requires active financial participation of both donors and recipients. This variable represents the most significant global-scale effort to support world-wide environmental protection efforts. [3]

[3] http://www.gefweb.org/Allocations_Disbursements.pdf

Where compliance is a high priority, other things equal, global obligations are more effectively honoured. WEF survey responses ranges from 1 (Strongly Disagree) to 7.

Climate change is a global environmental problem that can only be solved through international cooperation. This is a measure of national-level political commitment to address climate change. Countries receive one point for signature and one point for ratification. (UNCFFF, 2004)

Variable name	Denmark	Norway	Finland	Sweden
#of memberships in environmental intergovernmental orgs.	26	26	25	27
Percentage of CITES reporting requirements met	95.50	87.00	82.60	100.00
Levels of participation in the Vienna convention/Montreal protocol	2.5	3	3	3
Montreal protocol multilateral Fund participation	2.60	2.26	2.97	2.35
Global environmental facility participation	-0.07	-0.06	-0.06	-0.04
Compliance with environmental agreements	6.67	6.06	6.72	6.54
Levels of participation in the climate change convention	2	2	2	2

3.1.17 Reducing greenhouse emissions

Emissions of carbon dioxide are not immediately harmful to any given country, but contribute to global climate change. Every country emits some carbon dioxide. However, the amount of emissions per unit economic activity varies widely, with some countries being far more efficient than others also the amount per person varies widely, with some countries having much lower per capita emissions than others. The unit for first variable is metric tons/US dollar GDP and for the second is a metric ton(s) of carbon per person.

According to Jha& Murty (2003), CO2 related variables should also be included in environmental stress component instead of only in global stewardship component. The reason for that is domestic effect of CO2 emissions is as harmful as global effect towards domestic residents

Variable name	Denmark	Norway	Finland	Sweden
CO2 emissions per dollar GDP	1.08	0.74	1.28	0.70
CO2 emissions per capita	2.76	2.07	2.82	1.50

3.1.18 Reducing transboundary Environmental pressures

Emissions of CFCs contribute to the breakdown of the Earth's protective ozone layer and to global climate change. In ESI, total and per capita emissions are combined to create a measure which best captures global responsibility. The CFC measure is not available for individual European Union countries-so Sweden, Denmark and Finland report only their collective consumption as E.U.

The transport of sulphur emissions across national boundaries contributes to poor air quality and acid rain in receiving countries. For example, Danish SO2 emissions carried with the wind were contributing to environmental degradation in Sweden. (Jamison ,1997)

Many marine fisheries are becoming depleted and over fished. This is a measure of pressure on global marine fish resources. Large marine fish catches by one nation necessarily depletes the stocks available to other nations.

Many global fisheries are under stress. This is a measure of pressure on global fishing grounds. The greater the per capita consumption of seafood, the higher the pressure on this transboundary resource. Seafood supply represents the per capita availability of seafood, and includes
Production + Imports - Exports. According to this variable Denmark puts less pressure on this transboundary resource.

Variable name	Denmark	Norway	Finland	Sweden
CFC consumption(total times per capita)	-	58.24	-	-
SO2 exports	326.00	98.00	245.0	144.00

3.2 Criteria for selecting indicators

OECD defined general criteria for the selection of indicators. According to OECD, the indicators should be policy relevant, measurable and analytically sound.

POLICY RELEVANCE

An environmental indicator should:

- Provide a representative picture of environmental conditions, pressures on the environment or society's responses.
- Be simple, easy to interpret and able to show trends over time;
- Be responsive to changes in the environment and related human activities
- Provide basis for international comparisons
- Be either in national in scope applicable to regional environmental issues of national significance;
- Have a threshold or reference value against which to compare it, so that users are able to assess the significance of the values associated with it.

ANALYTICAL SOUNDNESS

An environmental indicator should:

- Be theoretically well-founded in technical and scientific terms
- Be based on international consensus about its validity
- Lend it self to being linked to economic models, forecasting and information systems.

MEASURABILITY

The data required to calculate the indicator should be:

- Readily available or made available at a reasonable cost/benefit ratio
- Adequately documented and of known quality
- Updated at regular intervals in accordance with reliable procedures

Environmental indicator criteria acc. to OECD	**Applicable to ESI**	**N/applicable to ESI**
Provide a representative picture of environmental conditions	**X**	
Be simple, easy to interpret	**X**	
Be responsive to changes in the environment	**X**	
Provide basis for international comparisons	**X**	
Be either in national in scope applicable to regional	**X**	
Have a threshold or reference value		**X**
Be theoretically well-founded		**X**
Be based on international consensus about its validity	**X**	
Lend it self to being linked to economic models		**X**
Readily available or made available at a reasonable cost/benefit ratio	**X**	
Adequately documented and of known quality	**X**	
Updated at regular intervals	**X**	

Table3.2

3.3 Weaknesses of ESI

The purpose of the ESI is to provide a consistent method of grading the progress of each nation's efforts to achieve environmental sustainability. No such index existed in the past. But still, in order for ESI to become an important management tool for governments and a valuable benchmark for business and civil society, its weaknesses should be taken into account.

If the ESI has one main weakness, it is its lack of organizational clarity. The five components seem to overlap. For any one variable, it is often unclear which component it belongs in. For example, Nitrogen concentration is linked to the water quality factor that comes under environmental systems. But fertilizer use is linked to the water pollution factor that comes under environmental stresses. And safe drinking water is linked to the basic sustenance factor that comes under human vulnerability.

The ESI also does not cover a number of important issues – e.g., quality of waste management, wetlands destruction, and exposure to heavy metals such as lead and mercury – because the requisite data are not collected or are not reported on a basis that permits cross-country comparisons. Another issue is concerning releases of toxins, carcinogens, endocrine disruptors and other known or potentially hazardous chemicals. There are no international programs to collect such information on a comparable basis, with the exception of a few targets of international regulation such as persistent organic pollutants (POPs).(Levy,2001 p:12)

The ESI team highlights its concern about limitations in the available data. The report declares that these deficiencies "drastically limit the ability of the world community to monitor the most basic pollution and natural ESI team recommends that the world community" invests in data collection and analysis" because "environmental policies need to be more data-driven." The task force also proposes making better use of information now fragmented in data sets throughout the world.

Some of the code of variables is not unidirectional. The first and foremost principle in formation of an index is that the sum total of the variable must yield an interpretation that is unidirectional. The final index must have a magnitude and direction, so that the index can be uniquely interpreted. Once the index is aggregated such differences would not be known to the users but would have serious implications for analysis. For the purpose of yielding such an interpretation a greater magnitude, for each variable, should mean betterment for environment. But in some of the variables the higher value indicates inferior condition for environments' sake. (Percent of land area having high anthropogenic impact, Subsidies to the commercial fishing sector, Subsidies for energy or materials usage, Percentage of ESI variables in publicly available data sets, Child death rate from respiratory diseases, Death rate from intestinal infectious diseases, etc.)

With further refinements, the ESI will be a stronger and more reliable index. And it will be a success because every society values the environment.

CHAPTER4
INDICATORS THAT HAVE IMPACT ON DANISH RANKING

In this part of the report, I would like to analyze indicators as well as some other variables which I believe has an important impact on Denmark's placing on the ranking. These indicators will be the ones that are significantly different or having lower values than other Nordic countries. My main focus will be on the critical differences rather than the similarities. From the indicators, I will analyze Eco efficiency (Energy), reducing air pollution, reducing water pollution, air quality, water quality, and environmental governance. Reason for concentration on those areas that I had mentioned above is because those areas can pose significant challenges to the country as it faces the future. Also those areas can lead to a variety of consequences such as airborne pollutants causes eutrophication and acidification. In other words, those indicators are packed up and by studying them further clear picture of extraordinary Danish ranking in ESI and its sudden fall in 2002 can be understood.

4.1 Eco efficiency

The more eco-efficient economy is, the higher its resource productivity and the less energy it needs to produce goods and services. Denmark's limitations of supply of energy sources and its realization about ''end of pipe solutions are not sufficient'' helped it to encourage energy-efficient technologies. (Jamison, 2001 p: 117)

The Nordic countries possess extensive energy resources and enjoy a high standard of living, as a result of which energy consumption per capita in the region is high. The Nordic countries consume a great deal of energy. This is due to their geographic location, low population densities, and energy-intensive industry. (Nordic council of ministers, 2004)

The most serious environmental problems in the field of energy are climate and pollution problems, and the risk imposed by the obsolete nuclear power stations in neighbouring states. Intensive efforts made over recent years have yielded results in terms of reduced pollution. It will be necessary to further reduce SO2 and NOx before the pollution problems can be solved.

A secure energy supply is important for maintaining a high rate of economic growth and ensuring that a modern society works as it should. One way of ensuring security of supply is to pursue active policies aimed at improving efficiency in all areas of energy use. More efficient energy utilisation also reduces the sector's impact on the environment through atmospheric emissions and discharges into water, etc.

4.1.1 Renewable Energy in Nordic Countries

Sweden

In Sweden, renewable energy accounts for a relatively large share of total energy consumption. Hydroelectric power accounts for about half of all electricity produced. Bio energy accounts for almost half of total energy consumption, excluding the transport sector, and its share is steadily increasing. Wind power is still very limited in absolute terms, but is on the increase. The growth in bio energy and wind power use is largely a result of energy and climate policy initiatives. On 1 May 2003, Sweden introduced a system of electricity certificates (green certificates) that replaced the bulk of government funding for renewable energy sources. Sweden also helps fund research and development in new technology and new expertise in an effort to reduce costs and eliminate both harmful environmental effects and other obstacles to greater use of renewable energy sources.
(Nordic council of ministers, 2004)

Finland

Renewable energy as a proportion of total energy consumption in Finland is approx. 24 per cent. The most important renewable energy source is bio energy, and here the country is one of the leading industrial nations in consumption terms. The paper and pulp industry has a key place in Finnish manufacturing, and bio energy meets approx. 55 per cent of its fuel needs.
(Nordic council of ministers, 2004)

Norway

The Norwegian energy situation is special as approx. 45 per cent of the country's energy consumption and over 99 per cent of its electricity production is derived from renewable energy sources. This is be-cause virtually all electricity in Norway is produced by hydroelectric power. The country is the sixth biggest hydroelectric power producer in the world and the largest in Europe. It has become highly skilled in managing all aspects of hydroelectric power projects, from the planning stage to the delivery and installation of hydroelectric equipment. (Nordic council of ministers, 2004)

Denmark

For every passing year, renewable energy accounts for an increasing share of Denmark's total energy consumption. In 2002, production of renewable energy accounted for 12.4 per cent of the country's temperature-corrected gross energy consumption, compared with 6.4 per cent in 1990 and 3.4 per cent in 1980. Biomass accounted for 43 per cent of all renewable energy production, while waste and wind power accounted for 32.5 and 17 per cent respectively. An increasing share of Denmark's electricity consumption is met by hydroelectric power. In 2002, wind power accounted for 13.9 per cent of the country's electricity supply, with a capacity of 2,886 MW. Wind power capacity and production do not grow at the same rate, however, as production in a given year is largely dependent on wind condition.

(Nordic council of ministers, 2004)

ESI 2001

Variable name	Denmark	Norway	Finland	Sweden
Energy Efficiency (total energy consumption per unit GDP)4 (1998)	4.84	12.17	8.37	9.14
Renewable Energy Production as a Percentage of Total Energy Consumption (1998)	4.81	64.03	19.11	35.06

ESI 2002

Variable name	Denmark	Norway	Finland	Sweden
Energy efficiency(total energy consumption per unit GDP)(1999)	6.42	14.90	10.99	10.98
Renewable energy production as a percentage of total energy consumption(1999)	5.13	66.18	17.61	33.95

[4] http://www.eia.doe.gov/emeu/international/contents.htm

4.1.2 Energy and Eco-efficiency in Denmark

The energy conservation discussion exploded in the Nordic countries, as in many other parts of the world, by the time of the first global oil crisis in 1973. This discussion resulted in energy conservation campaigns and alternative energy experiments. The awakened interest in renewable energy and conservation led to a series of technical developments in solar collectors (Sweden), wave power (Norway), wind power (Denmark), peat and forest fuel utilization (Finland) and geothermal energy (Iceland). (Berg &Livsey, 1992)

As an industrialised country, Denmark has a large consumption of heat, electricity and fuel. Because of the reliance on fossil fuels, CO_2 emissions are high about 10 tons/capita. The fuel mix is 43% oil, 24% natural gas, 21% coal and 12% renewable energy. Denmark has no nuclear power.

The Danish oil consumption comes primarily from Danish oil fields in the North Sea that have a production 2.18 times the Danish oil consumption.

The Ministry of Energy was established in 1979, mainly as an offshoot of the Ministry of trade; it became responsible both for off shore industry and energy planning. The ministries of environment and energy were merged in 1994, mainly because climate policies required more and better coordination between environmental and energy policies.

The Danish energy policies that were introduced after the energy crisis in 1973 were successful in reducing the dependence of oil imports, but one of the measures – change from oil to coal in the power sector – increased the air pollution considerably. During the same years, increasing evidence showed the environmentally harmful effects of the air pollution from the power sector: acidification of lakes and "forest death" from SO_2 and NO_X emissions, and global warming from CO_2 emissions.

Following the Brundtland Report and the Toronto Conference in 1988, an ambitious Danish energy minister Jens Bilgrav launched the Danish Energy Strategy "Energy 2000" in 1990 with an indicative target of 20% CO_2 reductions in between 1988-2005 and with proposals for over 80 energy policy measures, including CO_2-taxes. In the following years, the successive governments introduced most of the measures. In 1996, the energy & environmental minister Svend Auken updated the strategy with the energy strategy "Energy21" reinforcing the "Energy 2000" and aiming at further greenhouse gas reductions after 2005, including an indicative target of 50% CO_2 emission reductions 1990-2030. After the general elections in November 2001, a liberal government has taken over and there was no longer a "green majority" in the Parliament. The new government:

- gave up the CO_2 reduction target of –20% 1988-2005,
- cut away most of the support for renewable energy from the state budget,
- reduced energy taxation for the commercial sector,
- is increasingly inclined to use the flexible mechanisms to fulfil a large part of the Danish greenhouse gas target to the Kyoto Protocol. (Olesen, 2003)

The Danish Energy agency is founded in 1976 made up the greater part of the ministry of energy. It had two main responsibilities: The management of Denmark’s subsoil resources, mainly in North Sea where oil and gas are explored; and energy planning and savings, which includes the extension of renewable sources.

Denmark is the third largest oil producer in Western Europe, after Norway and Britain. Together with gas production, oil is an important reason why Denmark has had a balance of payments surplus since the beginning of the 1990s. Denmark's energy production is mainly based on imported coal, oil and natural gas from the Danish sector of the North Sea, as well as wind energy. In the Danish sector of the North Sea, oil and natural gas are produced in considerably larger quantities than are needed for domestic consumption. The oil and gas are taken ashore, distributed and exported via pipelines. The gas is exported to Sweden and Germany, while the surplus oil is mainly sold in the spot market. (Ministry of foreign affairs of Denmark, 2005)

The Nordic countries aim to limit the energy sector's contribution to environmental problems. A crucial challenge in connection with the task of moving the energy sector towards sustainability is to increase the use of renewable energy sources. Renewable energy accounts for a significant proportion of total energy consumption in the Nordic countries

4.2 Private Sector Responsiveness

The table with the indicator that rank the 142 countries contained in the ESI according to the private sector responsiveness shows that Denmark still scores lower than other Nordic countries. Although from 1993 onwards, there had been efforts to pass responsibility and policy initiative from the public to the private sector (Remmen, 1998.p:4)

Dow Jones Sustainability Index and Average Innovest Ecovalue rating of firms are oriented to the environmental stewardship of large companies .Those variables are included to highlight the central role of business in the quest for environmental progress in every society. (Esty, 2001P: 106

ESI 2001

Variable name	Denmark	Norway	Finland	Sweden
ISO 14001 Certified Companies per Million Dollars GDP5	0	0	0	0
Dow Jones Sustainability Group Index6	28.57	---	33.33	40.74
Average Innovest EcoValue '21 Rating of Firms	2.15	2	1.95	2.34
World business council on sustainable development members (Porter, 2001)	123.88	0	191.87	0
Levels of Environmental Competitiveness(Porter, 2001	5.70	5.40	5,80	5.40

[5] http://www.ecology.or.jp/isoworld/english/analy14k.htm, visited may 2005

[6] Assessment of the Country Allocation of the Dow Jones Sustainability Group Index", SAM Sustainability Group, 2001.

ESI 2002

Variable name	Denmark	Norway	Finland	Sweden
Number of ISO14001 certified companies per million $ GDP	64.32	23.48	54.67	101.23
Dow Jones Sustainability Group Index	33.10	33.10	84.90	56.60
Average innovest Ecovalue rating of firms	3.96	6.14	6.77	5.67
World business council for sustainable development members	22.33	48.59	35.27	10.52
Private sector environmental innovation	0.75	0.82	2.63	1.90

The EcoValue rating is the second most highly correlated variable with the Environmental Systems component according to the ESI analysts. It appears that good environmental management at the firm level is associated with environmental performance at the broader national level. As one can easily see from 2001 to 2002 there had been a significant increase in that variable in all Nordic countries except Denmark. Its increase is not as significant as the other Nordic countries.

Number of ISO companies is also worth mentioning. There had been an increase in number in all the Nordic countries. (See appendix F)

The new attempts to reduce the problems of environmental degradation were based on dialog between public and private interests that has characterised Danish approaches. The new belief was new commercialization and use of market forces in regulation.(Andersen, 1994) Being a merchant nation for a long time, Denmark welcomed the green technology as a new product to market .Denmark used this opportunity to be a pioneer in starting to produce greener products in industry to find green market niches before than other countries.(Jamison, 1998 p:103)As an example, wind turbine industry and environmental consulting engineering firms working abroad can be shown for this new belief. According to Jorgensen and Karnoe, this example shows the combination of innovative policies, local industrial entrepreneurship and political pressure of public debate shapes a new form of technology.

In the Nordic countries, Sweden and Finland in particular, businesses play a critical role for innovation while in the rest of the Region governments dominate. (IKED, 2003)

Finland and Sweden – leading the Region in terms of investing capital and human resources in R&D - follow a pattern that sets them apart from most other European countries: *Businesses* dominate R&D spending and employ most researchers, not government.

The ability of regional economies to withstand competition and adapt to technical change is related to their capacity to innovate. The increasing importance of knowledge (as compared with natural resources, physical capital and labour supply) in determining economic performance puts technology and innovation high on the development agenda.

Although Denmark has scored lower than other Nordic countries in the variable 'private sector environmental innovation', in practical Denmark is innovative. According to Global Competitiveness Report in 2003, 2004, Denmark scored on the fourth and fifth rank respectively. (Appendix I) In this variable several responses to certain WEF (World Economic Forum) survey questions are represented. As background for this report, the WEF conducts the Global Competitiveness Survey of about 3000 enterprises in 60 countries. This survey measures the perceptions of business executives about the country in which they operate. The survey asks top managers to rank on a 1 to 7 scale their opinion on issues in eight broad areas: 1) Openness, 2) Government, 3) Finance, 4) Infrastructure, 5) Technology, 6) Management, 7) Labour, and 8) Institutions.

Indicator: Private Sector Responsiveness according To WEF

Country name	**Score**
1. Finland	**2.87**
2. Switzerland	**2.64**
3. Croatia	**2.33**
4. Sweden	**1.87**
5. Norway	**1.83**
6. Netherlands	**1.82**
7. Costa Rica	**1.69**
8. Denmark	**1.52**

Table4.2

4.3 Air pollution

Denmark is a signatory to a large number of international environmental agreements, and Denmark has usually been an active proponent of relatively stringent environmental standards.[7]Despite its relative dependence on coal as an energy source, Denmark supports policies to reduce S02 and NOX. With regard to air pollution, Denmark is little affected because of lime layers in the underground and because of being a net pollutant exporter. (Bernes, 1993 p: 45)Also efforts to combat industrial air pollution in Denmark have not been as intense as those directed at water pollution. (Mogens, 1995)

In fact, it can also be stated that along with most of the European countries Denmark is a net pollutant exporter of deposited sulphur and nitrogen. This is to a large degree caused by the small size of the country where the pollutants do not have far to go to cross a border. For sulphur the net result was in 1996 that 54 kt or 59% of the Danish emissions of 93 kt S left the country in 1996. For all nitrogen compounds, both oxidised and reduced, the net export in 1996 from Denmark was 104 kt corresponding to 61% of the total annual emissions of 169 kt N. In ESI 2001, indicator, *reducing transboundary environmental pressures* presents this fact very clearly.

4.4 Reducing transboundary environmental pressures

ESI 2001

Variable name	Denmark	Norway	Finland	Sweden
CFC consumption(total times per capita)		58.24		
SO2 exports	326.00	98.00	245.0	144.00

[7] Miljostryelsen, 1998

ESI 2002

Variable name	Denmark	Norway	Finland	Sweden
CFC consumption(total times per capita)	-	58.24	-	-
SO2 exports	326.00	98.00	245.0	144.00

The air quality of Denmark compared to other Nordic countries is worse. In all the variables such as urban SO2, urban NO2 and urban total suspended particles concentration is higher. Natural background levels of these pollutants are low and deviations from the standard baseline can be trace back to anthropogenic emissions. They are all hazardous to human health. Sulphur dioxide and nitrogen dioxide are also harmful to flora and fauna.

4.5 Air quality

ESI 2001

Variable name	Denmark	Norway	Finland	Sweden
Urban SO2 concentration	7	5.47	4.38	5.23
Urban NO2 concentration	54.00	49.65	30.69	29.68
Urban TSP concentration	61.00	10.25	49.90	9

ESI 2002

Variable name	Denmark	Norway	Finland	Sweden
Urban SO2 concentration	7.00	5.47	4.38	5.23
Urban NO2 concentration	54.00	49.65	30.69	29.68
Urban TSP concentration	61.00	10.25	49.90	9.00

Dominant SO2 sources are industrial activities (e.g., iron ore smelting) and fossil fuel combustion (e.g., electricity generation).Coal fired power plants emit higher levels of S02 and other air pollutants than natural gas or oil fired plants, and the energy produced is more carbon-intensive. Denmark relies highly on coal for Energy supply. SO2 may cause respiratory problems. There are limit values for the allowed concentration of SO2 in the atmosphere.[8]

Dominant sources of NO2 are high temperature fossil fuel combustion in processes such as electricity generation and motor vehicles. The application of catalytic converter in the exhaust reduces the emission considerably. NO is relatively harmless, but NO2 can cause respiratory problems. To some degree, nitrogen also plays a role in the creation of ground-level ozone (which leads to loss of agricultural and forest productivity), destruction of ozone in the stratosphere (which leads to depletion of the ozone layer and increased UV-B radiation on Earth, causing increased incidence of skin cancer), and climate change. The resulting health effects include the consequences of ozone pollution on asthma and respiratory function, increased allergies and asthma due to increased pollen production, the risk of blue-baby syndrome, increased risk of cancer and other chronic diseases from nitrates in drinking water, and increased risk of a variety of pulmonary and cardiac diseases from production of fine particles in the atmosphere. (MEA, 2005)

According to National Environmental Research Institute, within the last 10 years it has been realised that total mass of the particles are more important in relation to health effects. Especially the sizes of the particles are important, but also the physical and chemical properties seem to play an important role. Measurements of PM10 and PM2.5 (particles with a diameter below 10 and 2.5 µm), are now included in the air quality monitoring programmes in USA and the EU. PM10 and PM2.5 measurements are carried out in Copenhagen in periods since 2002. The analysis of existing data from Copenhagen has shown that the most important contribution to PM10 in urban background is from traffic at busy streets in Copenhagen. The source of PM10 is road dust and wear of road surface, tires, brakes etc.

[8] www.dmu.dk

Fine particulate pollution (PM2.5) in Europe poses about the same risk to people's life expectancy as traffic accidents. Present levels of PM2.5 are now estimated to reduce Europeans' life expectancy by an average of approximately nine months. Diesel cars and trucks without particle filters are responsible for a large part of these emissions. At the same time almost all EU-countries grant high tax reductions for diesel fuel.

The Danish (EU) air quality limit values, which the Member States have to comply with in 2005, are exceeded at some locations. According to DMU, the particle emissions from the traffic can be reduced by different measures, e.g.

- Particle filters on heavy duty vehicles,
- Requirements of filters in tenders for operation of public bus lines,
- Environmental zones,
- Traffic planning,
- Better fuel,
- Reduction of traffic
- etc.

4.6 Reducing air pollution

ESI 2001

Variable name	Denmark	Norway	Finland	Sweden
SO2 emissions per populated area	12.86	1.19	2.62	1.30
VOCs emissions per populated land area	25.10	2.24	1.71	1.71
NOx emissions per populated land area	7.19	0.78	0.86	0.63
Vehicles per populated land area	51.16	19.13	15.19	18.44
Coal consumption per populated land area	3.16	0.38	0.82	0.34

ESI 2002

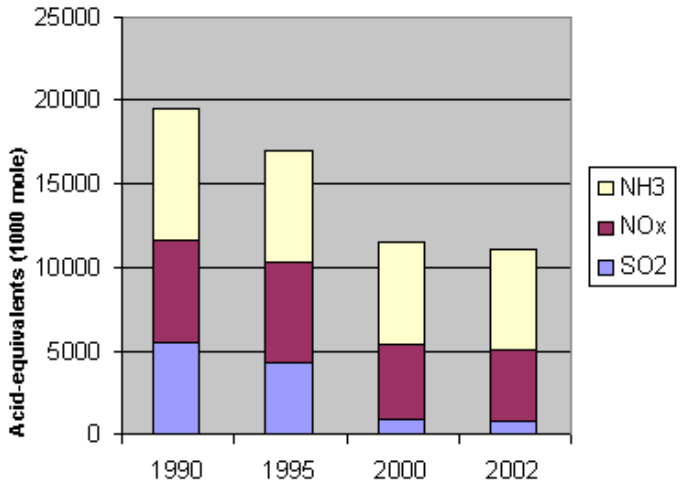
Variable name	Denmark	Norway	Finland	Sweden
SO2 emissions per populated area	2.86	0.35	1.48	0.77
VOCs emissions per populated land area	4.45	0.76	0.47	0.68
NOx emissions per populated land area	54.88	15.69	0.19	0.27
Vehicles per populated land area	50.91	19.42	15.67	18.84
Coal consumption per populated land area	4.69	0.38	0.95	0.40

The depositions of sulphur and nitrogen have adverse effects on the eco-systems. However, the decreasing trends of concentrations in air (in dry deposition), as well as in precipitation (in wet deposition) will have beneficial effects on the Danish ecosystems. But the depositions still exceed the critical loads in many parts of the country. [9]

For acidification the situation has improved considerably over the last 20 years because of the emission reductions. On the European level the areas of exceedance have decreased from about 25% of the total land area before 1990 to 8-13% in 1996-1997. In Denmark the corresponding figures reveal a decrease from 7-8% to about 2%.

[9] Available electronic at www.dmu.dk

The figure shows the emission of Danish acidifying gases in terms of acid equivalents. In 1990 the relative contribution in acid equivalents was almost equal for the three gases. In 2002 the most important acidification factor in Denmark was ammonia nitrogen and the relative contributions for SO2, NOx and NH3 were 7%, 39% and 54%. However, regarding long range transport of air pollution SO2 and NOx are still the most important pollutants.

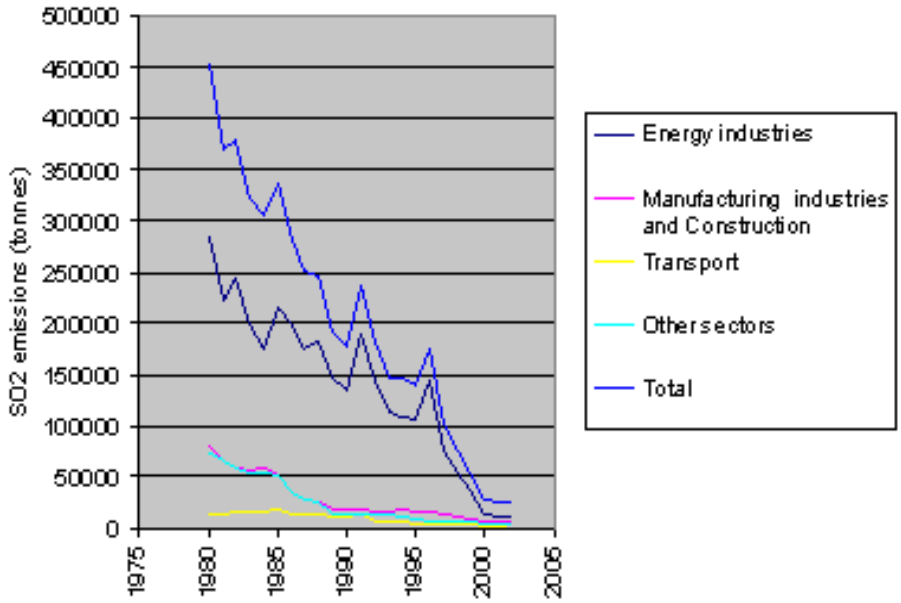


Relative contribution in 2001 in acid equivalents and time series.

The decrease for both gaseous and particulate sulphur since around 1980 must be seen as the result of a widespread effort to curb emissions through introduction of stack exhaust cleaning technologies. That was a consequence of an increased awareness of the acidification problems and the demonstrations that air pollution can travel considerable distances from the sources (OECD 1977).

4.6.1 SULPHUR DIOXIDE

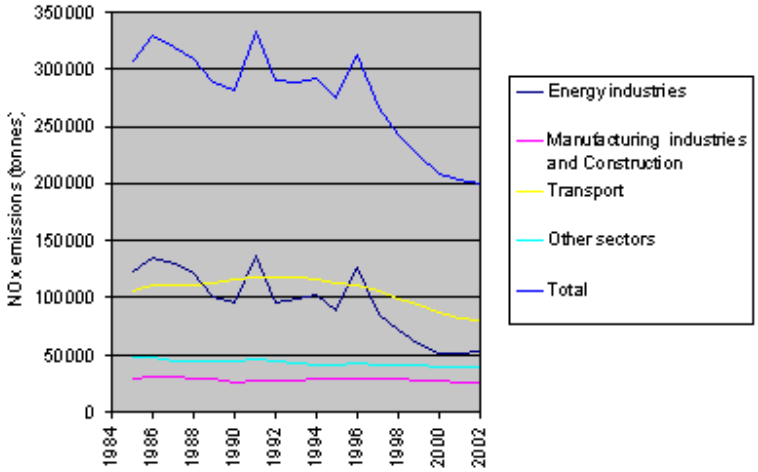
The main part of the SO2 emissions originates from combustion of fossil fuels – mainly coal and oil – on public power and district heating plants. From 1980 to 2002 the total emission has decreased by 94%. The large reduction is mainly due to installation of desulphurization plants and use of fuels with lower content of sulphur in public power and district heating plants. Despite the large reduction of the SO2 emissions these plants make up 43% of the total emission. Also emissions from industrial combustion plants, non-industrial combustion plants and other mobile sources are important. National sea traffic (navigation and fishing) contributes with about 11% of the total SO2 emission. This is due to the use of residual oil with high content of sulphur.



4.6.2 NITROGEN OXIDES

The three largest - and almost equal in size – sources are combustion in energy industries (mainly public power and district heating plants), road transport and other mobile sources. The transport sector is the sector contributing the most to the emission of NOX and in 2002 40% of the Danish emissions of NOX stemmed from road transport, national navigation, railways and civil aviation. Also emissions from national fishing and off-road vehicles contribute significantly to the NOX emission. For non-industrial combustion plants the main sources are combustion of gas oil, natural

gas and wood in residential plants. The emissions from public power plants and district heating plants have decreased by 57% from 1985 to 2002. In the same period the total emission has decreased by 35%. The reduction is due to an increasing use of catalyst cars and installation of low-NOX-burners and de-NOX-units on power and district heating plants.

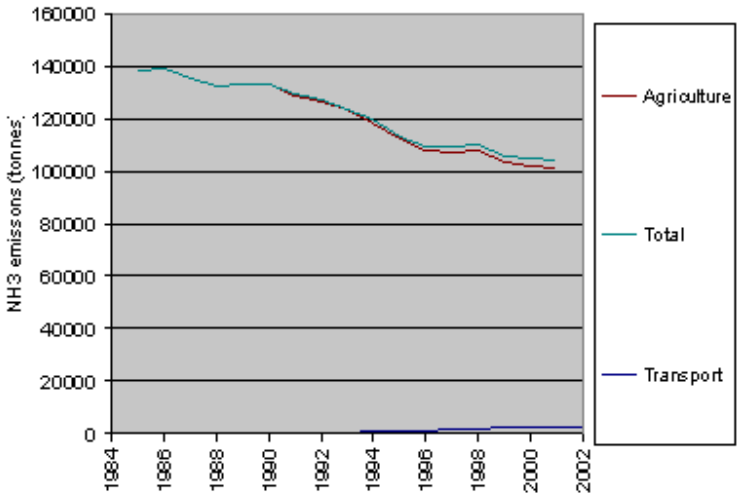


4.6.3 AMMONIA

Almost all atmospheric emissions of NH3 result from agricultural activities. Only a minor part originates from road transport. This part is, however, increasing due to increasing use of catalyst cars. The major part of the emission from agriculture stems from livestock manure (79%) and the biggest losses of ammonia occur during the handling of the manure in stables and when spreading on fields. Other contributions come from crops (14%), artificial fertilisers (6%) and ammonia used for straw treatment (1%).

The total ammonia emission from the agricultural sector has decreased by 29% from 1985 to 2002. This is due to the offensive national environmental policy during the last twenty years. Due to the Action Plan on the Aquatic Environment and the Ammonia Action Plan a series of measures to prevent loss of nitrogen in the agricultural production have been initiated.

The measures have included demands on improved utilisation of nitrogen in husbandry manure, ban against application of husbandry manure in winter, broad spreading of manure is prohibited, demand on establishment of second growth, regulation of the number of animals per hectare and a ceiling for the supply of nitrogen to crops. So despite an increase in the livestock production the evaporation of ammonia has been reduced considerably.[10]



[10] www.dmu.dk

4.7 Reducing ecosystem stress

ESI 2001

Variable name	Denmark	Norway	Finland	Sweden
Percentage change in forest cover 1990-2000	-	0.02	-	-
Percentage of country with acidification exceedance	54.88	15.96	1.19	34.37

ESI 2002

Variable name	Denmark	Norway	Finland	Sweden
Percentage change in forest cover 1990-2000	0.20	0.40	0.00	0.00
Percentage of country with acidification exceedance	54.88	15.96	1.19	34.37

4.8 Water quality

Agriculture is integral to Danish society, making significant contributions to the economy, rural communities and food security. A major question facing the agricultural sector however is the long term environmental sustainability of production .The last century witnessed great development in many agricultural technologies such as high-yielding crop varieties, chemical fertilizers, pesticides, irrigation and mechanization. These developments resulted in agricultural operations becoming increasingly specialized so that emphasis is now either livestock rearing or intensive cropping.

Considerable amounts of chemical inputs (fertilizer and pesticides) are required for crop production. In the case of intensive livestock operations, inadequate acreages of nearby cropland have resulted in manure being regarded in some locales as a waste requiring disposal, rather than as a fertilizer and soil amendment. These issues have raised concerns about the effect of agricultural activities of water quality.[11]

[11] http://www.ccme.ca/initiatives/water.html?category_id=82#236

At present, environmental problems caused by excessive nutrients are severe in Denmark Since Denmark has a long history of settlement and agricultural production. Also due to the relatively big population compared to the land base and lenient protective measures implemented, water pollution got critical.

Addition of N and P to ecosystems as a result of human activity has resulted in deleterious changes in water quality. Agriculture can accelerate the movement of nutrients to surface or ground waters, particularly from overuse of fertilizers and inappropriate manure management practises. While addition of fertilizer and manure to agricultural soils is essential for soil health and optimal crop yield, application in excess of plant requirements can lead to a build up of nutrients in the soil and their loss to environment. P and N moving off farmland may elevate concentration of these nutrients in surface waters and thus cause eutrophication, a condition characterized by excessive growth of aquatic plants that, in turn causes loss of habitat for other aquatic organisms. Increased organic matter production resulting from nutrient addition can lower oxygen concentration in water to an extent that threatens fish survival. High concentrations of certain forms of N can be toxic to humans and aquatic organisms. It can be converted in the digestive tracts of human infants and ruminant animals.

Also many impacts of humans on ecosystems (both harmful and beneficial) are slow to become apparent; this can result in the costs associated with ecosystem changes being deferred to future generations. For example, excessive phosphorus is accumulating in many agricultural soils, threatening rivers, lakes, and coastal oceans with increased eutrophication. Yet it may take years or decades for the full impact of the phosphorus to become apparent through erosion and other processes. (MEA, 2005)

ESI 2001

Variable name	Denmark	Norway	Finland	Sweden
Dissolved oxygen concentration	-	-	11.19	-
Phosphorous concentration	-	0.01	0.01	-
Suspended solids	-	-	1.17	-
Electrical conductivity	-	0.61	50.49	77.56

ESI 2002

Variable name	Denmark	Norway	Finland	Sweden
Dissolved oxygen concentration	10.00	11.19	11.19	9.27
Phosphorous concentration	0.14	0.01	0.01	0.28
Suspended solids	2.62	3.02	1.17	2.47
Electrical conductivity	422.19	0.61	50.49	77.56

Dissolved oxygen: This is a “headline” indicator for water. It tracks eutrophication levels, and is positively related with stream flow and inversely related to nitrogen and phosphorous levels. The U.S. National Research Council report (2000) listed dissolved oxygen as one of four indicators that provide crucial measures of ecosystem health

With regard to eutrophication of marine waters, there has been no improvement in Denmark. Although, discharges from municipal sewage treatment plants and industrial outfalls have been reduced, the decisive factor is nitrate leaching from agriculture. And nitrate leaching from agriculture has not been reduced to any significant extent. (Heidam, 1998)

The critical loads for eutrophication are still exceeded in large parts of the country with about 500 - 1000 kg N·km-2·yr-1 (0.35-0.75 keq·ha-1·yr-1). The exceedances reach maximum values of more than 1000 kg N·km-2·yr-1 (0.75 keq·ha-1·yr-1) in the southern part of Jutland (Holten-Andersen et al. 1998).

Incidents of eutrophication of the interior Danish seawaters in 1980's turned attention to nutrient pollution from agricultural run-off, mainly caused by nitrogen. Encouraged by the government, which wanted to maximize the benefit of common agricultural policy (CAP), farmers invested and specialized so as to increase their production as much as possible. Livestock production become concentrated in the western part of Jutland on sandy soils where the yield from corps was small and which were the most vulnerable to nitrate leakage.

In 1986, Nature conservation society demanded 50% reduction in discharges from agriculture, cities and industries. Within less than 4 weeks, its demands had been accepted and made official policy
In 1988, the ministry of environment formally listed the environmental issues as the most important to Denmark. One of the four issues was the nutrient eutrophication of marine waters.[12]

Danish lakes have considerable phosphorous stored in the lake sediment. This accumulation had started around modern development (1960).The main sources are leaching from cultivated areas, urban sewage etc .It is proven that it will take decades before the lakes become as clear as they were prior to 1960's. In fact, there is some doubt as to whether it will ever be possible.

Conductivity of water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulphate and phosphate anions, or sodium, magnesium, calcium, iron and aluminium cations. It is important to note that geology can have a large impact of electrical conductivity. Streams that run through bedrock areas tend to have a lower conductivity whereas streams that run through soils tend to have a higher conductivity.

4.9 Reducing water stress

Intensive agricultural operations cause some environmentally significant losses. Livestock incorporate only 20 to 40% of the phosphorous and nitrogen originally present in the feed; the remainder is excreted. Phosphorous in corn, barley and other cereal grains fed to pigs is the most serious problem because between60 and 80%of the phosphorous is in a form (known as phytate)

[12] miljøstyrelsen, 1988

that is not digested. There are varieties of strategies to reduce the phosphorous content of livestock manure. One currently employed with hogs is to reduce supplemental phosphate in the diet and add the enzyme phytase to the feed. Addition of phytase to the diet can result in a 25-30% reduction in fecal phosphorous for pigs.

Another approach for reducing fecal phosphorous is to feed pigs cereal grains containing more bio available phosphorous and less phytate.This method can reduce fecal phosphorous content by 25%.

A third approach is to produce transgenic pigs that synthesize their own phytase.These pigs can excrete feces with up to 75%less phosphorous than non transgenic pigs receiving the same diet. However phytase pigs are genetically modified animals and safety testing is necessary to meet the requirements by the State. Furthermore acceptance by consumers will be the final barrier to their introduction.

Few methods are available for reducing the nitrogen content of fecal material. Studies have shown that use of supplementary amino acids combined reduced levels of protein in the food can reduce nitrogen content of fecal material by 20-25%.[13]

ESI 2001

Variable name	Denmark	Norway	Finland	Sweden
Fertilizer consumption per hectare of arable land	1,882.45	2,308.20	1,453.43	1,104.17
Pesticide use per hectare of cropland	2,200.00	941	410	509
Industrial organic pollutants per available freshwater	5,674,21	188.19	608.04	604.04
Percentage of country's territory under severe water stress	7.70	0.40	2.10	0.60

[13] CCME sponsored workshop: Effects of agricultural activities on water quality.

ESI 2002

Variable name	Denmark	Norway	Finland	Sweden
Fertilizer consumption per hectare of arable land	1704.2	2257.71	1407.48	1006.47
Pesticide use per hectare of cropland	2200.00	941.00	410.00	509.00
Industrial organic pollutants per available freshwater	7.13	0.20	0.61	0.62
Percentage of country's territory under severe water stress	7.70	0.40	2.10	0.60

CHAPTER5
DANISH ENVIRONMENTAL GOVERNANCE

In this chapter, SWOT Analysis on Danish environmental governance and Danish membership in European Union (EU) will be studied. The reason for adding EU membership is because the European Union has left its marks most clearly on agriculture, transport, communication, industry, energy and Environmental policies in Denmark. **(**Lagreid, 2001 p:5). That is why when discussing about governance, it is necessary to bring E.U into the picture especially when Denmark is involved. Denmark had been a member in E.U for 32 years, much longer than other Nordic countries. (Sweden and Finland are members for 10 years.)

5.1 SWOT Analysis

The purpose of this chapter is to analyze and evaluate Danish experience with respect to environmental governance. Also about what can be done in order to improve Danish environmental sustainability track. The tool for making the analysis is the SWOT –analysis, where **SWOT** is an abbreviation of **S**trengths, **W**eaknesses, **O**pportunities and **T**hreats. The SWOT- analysis commonly used in business circles to investigate a product or a company in relation to other products/companies. The predictive capabilities of the tool come about from the consideration of each system's strengths and weaknesses in the context of the environment, which is seen to present opportunities and threats. The intention is to determine how each product will fare in the light of changes taking place around it. (Turk, 2002) In this analysis, Danish environmental governance will be seen as a product and will be compared with other Nordic countries' environmental governances.

SWOT analysis can help to build on the strengths, to minimize the weaknesses, to seize the opportunities and to counteract threats. The SWOT-analysis can at least provide perspective, and at best will reveal connections and areas for action.

The Environmental Sustainability Index is not about how bad things are. It is about *how* they are. And now it is important to find out what can be done about it especially from Danish perspective. Such assessments can help governments, businesses to shape sustainable development. With this index, the governments at last have at hand a clear and comprehensive measure of human impact on the Earth. The measure shows where the state of environmental systems is, the stresses posed to the environment by human activities, how human's means of living are affected. Also the measure introduces potential power of nation's sustainability as well as the global responsibilities the nation.

This type of simple and accessible tool can finally put the abstract sustainability concept into concrete terms.

Environmental sustainability index can move the sustainability agenda to action. ESI can promote better environmental policies in two ways. The ESI can provide environmental regulators a new management tool. As Esty (2001 p: 10610) notes, this will be important for a field that "has historically been unsophisticated in its use of management tools." Also the ESI can give business and civil society the information they need to push for better environmental laws and practices.

After analyzing the index, there are areas that Denmark can concentrate more in order to sustain its environment. The numbers of this report tells about the strengths, weaknesses and the outcomes for Denmark. It can help Danish government to become promoter of sustainability. But one should keep on mind that the application of sustainability indicators at local and national scales involves a trade-off between comparability and action. Some of the indicators are oversimplified in ESI in order to be comparable at a national level so that it lost its tool properties. It is clearly important to monitor progress towards environmental sustainability goals at national scales

	STRENGTHS 1.Public participation. 2.StrongLocalAdministration 3.High innovation capacity in market 4.Long EU membership 5.Relative openness and accessibility of information 6. Direct involvement of NGOs in the political process in Denmark,	WEAKNESSES 1.Enforcement power at local level is low 2.Globalcommonsmanagement 3.Powerfullobbies 4.Compromise in policy making 5.Strong decentralization
OPPORTUNITIES 1.Marketing 2.Pioneer in policy.	Opportunity-Strength(OS) Strategies Use strength sto take advantage of opportunities .Relative openness and accessibility of information .High innovation capacity in market	Opportunity-Weakness (OW) Strategies Overcome weaknesses by taking advantage of opportunities 1.Enforcement power can get stronger with the help of pionneership in policy 2. Powerful lobbies can take a backseat with the help of marketing new goods.
THREATS 1.Weak enforcement at local level 2. Powerful lobbies Can be very influential	Threat-Strength (TS) Strategies Use strengths to avoid threats 1.Strongpublicparticipation can overcome the weakness 2.Relative openness and accessibility of information 3 Direct involvements of NGOs	Threat-Weakness (TW) Strategies Minimize weaknesses and avoid threats 1. Taking the lobbies out of the picture in political decision-making 2.Weaker decentralization towards centralization can improve enforcement power at local level

Table 5.1

5.1.1 Strengths

The strengths are containing all the advantages that Denmark has and state where Denmark is better than other related Nordic countries· Laws, policies, institutions, and markets that have been shaped through public participation in decision-making are more likely to be effective and perceived as just. In Denmark, public participation had always been a dynamic force that has an effect on policy making especially the NGO's direct involvement in the political processes. Also knowledgeable public which keeps the government accountable due to the easy access to information are good assets to have. All those assure democratic action in decision making and it is very healthy for a society. Denmark is locally and regionally (E.U) very powerful. For sustainable development, local, regional and global communities should be in balance and be effective. Denmark's decentralized system allows for the strong local administration and to be a long time membership to E.U permits Denmark to have a high responsibility towards its environmental actions. This can in the long run help to improve Danish environmental sustainability track. Danish effective innovation capacity is another asset that can help Denmark for its environmental sustainability goals such as marketing green technology. Denmark has a deep cultural knowledge of consumer market tastes which facilitates consumer product innovations. (Lundvall, 1994 p:12-13).

5.1.2 Weaknesses

The weaknesses are the disadvantages for Denmark and how it is weaker in comparison to other related Nordic countries. Denmark, due to its decentralized structure has to cope with problems especially concerning global commons. The communities, most of the time is insufficient to manage environmental problems since they are beyond their reach. The enforcement power at the local level which naturally affects the regional and global level as well is having some limitations. As a current example, DK had been having problems with EU commission on poor water quality in April 2005**.** DK had failed to inform local authorities how to report sources of poor water quality. In some areas, municipalities were forced to do their analysis without any help of guidelines. When it is environmental issues, the local inefficiencies magnify themselves in the regional and global context. Historically Denmark had been practising consensual regime in the parliament. Meaning that regime relies on compromises and negotiations.

This can be considered as weakness when it comes to decision-making involving environment. The decisions can never be as effective as they planned to be due to the compromises. Especially, in the Danish context, the existence of strong lobbies (Dansk industri and landbrugsrådet) has an unbalanced influence and power to tilt the environmental policy agenda. In fact it was often said that the Environmental Protection Act did not apply to' Greenland, the Faeroe Islands and agriculture'. (Andersen, 1997p:265)

5.1.3 Opportunities

Opportunities are potentials for Denmark in the future. Better environmental governance can bring more sustainable environment benefits or possibilities for marketing new technological green products for Denmark. In the regional level, sustainable development has become the main perspective for EU. National programs are coordinated and supplemented by collective approaches of member countries. This encouragement can offer an opportunity for Denmark to achieve sustainable development. Denmark can originate its national environmental laws which in return can be transferred to the European level, followed by implementation of member states. (Brujin, 2001) This means Denmark can be a pioneer in European Environmental policy and finally get out of its shade for a bright future. (Andersen, 1997p:251)Also it would be easier for Denmark to implement those laws directed by EU commission, since they had been originated in its national borders

5.1.4 Threats

The threats are how other Nordic countries are better and stronger than Denmark as well as the waiting threats of non-sustainable future. There are obstacles waiting for Denmark especially with the water and air pollution if further action is not taken. According to the reports mentioned in the project, the pollution levels are now at an unacceptable stage. Also the compromise nature of the parliament can take advantage of the environment. The current political regime is not so much in favour of green policies and this can let some of the powerful lobbies to take over on deciding environmental policies.

5.2 EU and Denmark

European Union member States have occasionally failed to comply with EU directives and laws. Non- compliance or non-implementation is defined as a situation in which a member state has failed to translate an EU directive into law. Liberal inter govern mentalist assumption argues that member states should commit more non-compliance when their membership in the EU is short and when their economic power is low. Long time members have fewer cases of non-compliance before the court of justice because they have more power. The commission may find it difficult as well as impolitic to draw action against a member states with a great deal of power. Also having a unitary, hierarchical state structure will cause a state to commit fewer incidences of non-compliance. States with more autonomous local and regional governmental structure will commit more non-compliance. (Rasmussen, 1988) p: 102-104

" *Hierarchical states in which great authority is vested in the central government will find it easier to translate the provisions of international regimes into national law than decentralized systems in which the central government has limited control over regional and local government.* "

Mark Levy et al, 2002, pp: 16

In a decentralized system, the central government may have difficulty in compelling local governments to implement international law simply because they do not have the power to do so.

It appears that many factors influence non-compliance. Cases of non-compliance fall with the length of membership and strong economy and increase with decentralized systems.

Denmark had been the member of EU since 1973, while Finland and Sweden joined in 1995. Sweden demanded that the country would not have to lower its environmental standards in fields where it has stricter rules than the EU. The outcome was that Sweden is allowed to keep its rules while waiting for the EU to move closer to Swedish standards

Factors of Non-Compliance and Nordic EU countries

Country name	**Finland**	**Denmark**	**Sweden**
Length of membership	From **1995** until present	From **1973** until present	From **1995** until present
Contribution to the common EU budget	slightly over 1 per cent of GDP - FIM 5.8-7.0 billion[14]	2.1 per cent of the total GDP of EU	SEK 25 billion per year[15]
Number of votes in Council	7	7	10
Type of system	Centralized	Decentralized	Centralized

* The EU budget amounts to almost 900 billion SEK per year. [16]

Table 5.2

According to Rasmussen (1988), p: 17 Denmark widely publicizes its compliance as a way to raise its status among its EU partners. Also Rasmussen, (1988) p: 17states that Denmark is accommodating itself to its EU membership by formalizing its procedures for implementing laws.

Legislation in Denmark uses broad framework laws. Implementation of decisions on guidelines is left to negotiations between major interest organisations and the ministry. As Denmark has a profound decentralised political and administrative structure (Christiansen & Lundqvist 1996 P: 350) regulators in Denmark have a lot of discretion and are expected to take the local situation into account. Denmark has a well-established tradition of formal and informal collaboration between parties. Denmark is a late industrialist. Even today there are few large industrial plants and there is relatively little heavy industry (Andersen, 1997, p: 252)

[14] virtual.finland.fi/finfo/english/eu_econ.html - 40k

[15] http://www.sweden.se/templates/cs/BasicFactsheet____3128.aspx

[16] www.eu-upplysningen.se

The Copenhagen Post on 6th of April 2005 stated that the European Union Commission has issued a warning to Denmark for neglecting to enforce its water pollution legislation. The admonishment came as Denmark did not inform the commission which governing body would administer an EU directive on water quality.

The commission lost its patience and took preliminary steps to dragging Danish authorities to court. The Commission sent a letter criticising the Danish Environmental Protection Agency (EPA) for failing to inform local authorities how to report sources of poor water quality. In some areas, municipalities were forced to do their analysis without any help of guidelines.

In addition, the Danish EPA delivered another set of guidelines the day before local authorities were supposed to begin enforcing them. The guidelines concerned pollution such as antibiotics and cleaning agents used by fisheries, which find their way into Danish waterways.

5.2.1 What does multilevel governance mean for Denmark?

It means declining capacity of the government since they are totally or partially in control of other governments or policy networks. So the government is not in the hands of any public and accountable body. That is citizens cannot expect to influence through elections or democratic institutions. It is a problem for Denmark as a very strong decentralized, individualistic country. For Norway, it is not as severe as Denmark. It is also decentralized but not part of the E.U. Danish policy system is full of compromises and negotiations. So in that way, having no public influence influences political decisions. At the same time, according to Paldam&Nannestad, (1994) country with a more internationalized economy such as Denmark appeared to be held less accountable by its citizens about the results of its national economy.

5.3 Political regime shift

In 2001, there had been a shift in the political regime in Denmark. This shift had some dramatic changes in the environmental policy arena. The new government made a change in the broad-based form of parliamentary decision –making.
The consensual regime had been replaced by neo-liberal regime which puts emphasis on financial and economic approach rather than the ethical and democratic approach. (Jamison&Møhl, 2004)
The consensual regime‘s decisions are built on compromises and negotiations while the neo liberal regime’s decisions are more pragmatic and opinionated. This new way of decision-making is revolutionary for Danish structure. Since Denmark had always been a nation of two political cultures. (Urban and rural cultures.) The urban side of the culture is more individualistic and merchant in nature .On the other hand, the rural side is more collectivist and farmer in nature. Those two extreme poles in the political arena had always been finding middle ground for years. This delicate balance had been put at risk in the last election.

It is critical to find out if this shift had any influence on environmental sustainability decisions in Denmark. In chapter 1, it had been mentioned that status quo policies are an insufficient answer to the needs of sustainable development. (Kothari, 1990)

For the status quo supporters or in the Danish context, for the neo liberal, sustainable development is identified with growth .Economic growth is seen as part of the solution for the supporters of the status quo. They are in favour for the changes in the role of government over recent decades especially with the reduction in the progressive nature of taxation, cuts in the social wage, privatization and reduction in regulation. (Hopwood et al, 2005)

For status quo supporters, increased information, changing values, improved management techniques and new technology all operating through the market are the best means to achieve sustainable development.

Lomborg (2001 p: 32) challenges most of the claims of those concerned about the environment, and supports cost benefit analysis to solve environmental problems.

Supporters of the status quo are reluctant to use laws and regulations. Instead, consumer power, informed about sustainability issues and based on lifestyle choices, will combine with 'green' capitalists who practice 'corporate citizenship' and ethical business to achieve sustainable development. (Elkington&Burke, 1987).

For status quo supporters (neo liberals), technical economic tools such as modest environmental taxes, pollution trading permits and ethical shares will encourage the move to sustainable development. Thor Pedersen, new minister of finance, at the end of January 2002 eliminated all of the green taxes in Denmark. (Jamison&Møhl, 2004 p: 27)

Defenders of status quo do not see the interrelatedness of environment, society and economy. Instead of improving this linkage to function better, they believe technology all operating through the market can bring sustainability to life.

On the other hand, according to governance indicators that are prepared by World Bank (see table5.3) Denmark is scoring extremely high in all indicators between 1998 until 2004.It looks as if the political shift did not have such a drastic change in Danish governance. Also in ESI, governance indicator has a high score for Denmark.

This shows that either there is no correlation between the political shift and environmental performance or the indicators that are measuring governance do not take into consideration the environmental aspect.

Statistical Table 5.3: All six governance indicators for DENMARK

Governance Indicator	Year	Percentile Rank (0-100)	Estimate (-2.5 to + 2.5)	Standard Deviation	Number of surveys/ polls
Voice and Accountability	2004	100.0	+1.59	0.16	10
	2002	100.0	+1.72	0.17	10
	2000	96.9	+1.51	0.21	7
	1998	97.9	+1.51	0.23	5
Political Stability	2004	89.8	+1.21	0.19	12
	2002	90.8	+1.26	0.20	9
	2000	94.5	+1.45	0.23	9
	1998	91.5	+1.40	0.24	6
Government Effectiveness	2004	98.6	+2.15	0.17	10
	2002	96.5	+2.05	0.16	9
	2000	94.6	+1.84	0.19	8
	1998	97.3	+2.13	0.25	6
Regulatory Quality	2004	97.0	+1.76	0.21	8
	2002	97.4	+1.74	0.18	7
	2000	93.6	+1.41	0.29	5
	1998	95.1	+1.40	0.23	5
Rule of Law	2004	97.1	+1.91	0.13	12
	2002	98.0	+1.93	0.13	12
	2000	93.6	+1.95	0.16	11
	1998	95.1	+1.99	0.19	9
Control of Corruption	2004	98.0	+2.38	0.14	11
	2002	98.5	+2.25	0.15	9
	2000	97.3	+2.38	0.18	9
	1998	99.5	+2.57	0.18	8

Source: Kaufmann D., A. Kraay, and M. Mastruzzi 2005: Governance Matters IV: Governance Indicators for 1996-2004.

***** The other Nordic countries scores on governance indicators can be seen in Appendix D

CHAPTER 6 DANISH CASE

6.1 Danish way of policy making

The way to engage in a strategy for a more sustainable development is through the utilization of new instruments in environmental policy. In Denmark, during the 1980's new instruments were developed as substitutes for or supplements to traditional administrative instruments. The two major types of instruments are economic instruments and voluntary agreements between state and business. (Christiansen, 1996p: 57)

A third instrument which is the introduction of environmental, assessments is not very well developed in Denmark compared to the tradition of the rest of Europe.(Rydevik, 2001) Environmental assessments investigate potential environmental consequences in the private as well as in public sector before the project is put into action. In Norway, in order to improve he effectiveness and environmental aspects of municipal activities, parliament passed a new chapter in the Planning and Building Act. This chapter required industry to make environmental impact assessments. EIA is forcing industries to present responsible solutions and mitigating measures due to industrial changes to municipalities and other interested parties. (Østby, 1997)

A clear development is the further internationalization of environmental policies in the middle of 1980's.It is recognized that a number of serious environmental problems can not be solved without international cooperation. The most important institution pursuing effective environmental policies was the EU. The expansion of EU with Finland, Sweden –all belonging to the 'pro-environmental coalition'- is believed to strengthen environmental policy in the EU.

Christiansen states from a Danish point of view it is a clear problem that so much of environmental decision making has been moved to the EU: In the regulations supporting the internal market, Denmark is generally not allowed to introduce stronger environmental demands than those agreed upon in the council. EU regulations clearly restrict national environmental initiatives.

According to the variable in ESI, *Stringency and Consistency of Environmental Regulations,* which takes the response to survey questions such as:

- "Air pollution regulations are among the worlds most stringent";
- "Water pollution regulations are among the worlds most stringent";
- "Environmental regulations are enforced consistently and fairly";
- "Environmental regulations are typically enacted ahead of most other countries."

as a criteria for stringency of environmental regulations; Denmark scores very high and this shows that participants strongly agree that Denmark has stringent environmental regulations.

Variable name	**Denmark**	**Norway**	**Finland**	**Sweden**
Stringency and Consistency of Environmental Regulations	6.38	5.65	6.38	6.10

*Survey responses ranging from o to 7

But having stringent environmental regulations and having stringent enforcement are two different side of the coin. Denmark's decentralized structure sometimes weakens the local authority on the environmental issues.

The decentralized administrative structure remains a core trait of Danish Environmental policy. It was however challenged in the 1980's by criticism of the counties', and mainly the municipalities (lack of) efforts in pursuit of effective implementation. There were many indications that the local authorities had not implemented regulations and laws of 1970's in the way they should have had.[17]After using legal options for access to public files, environmentalists found that most of both the larger and smaller companies investigated had breached their environmental permits.
(Larsen and Christensen, 1985 p: 22)

[17] Miljostryelsen,1985;DIOS,1987)

Those breaches had not been treated as violation of the law since the local authorities had often been privy to them. The local authorities often responded by issuing new and more lenient permits to the industries in question.

Denmark's tradition for local administration and decentralisation is stronger than other countries. Local municipalities enjoy their autonomy. They collect their own income taxes, and this makes up about one third of all taxes .In only few other places in the EU do local authorities have such a share in taxation. (Andersen, 1997 p:270)

The local authorities were given an important role in the implementation of most environmental laws. They were also given the responsibility for issuing the permits to companies required to have a permit for their operation according to the Environmental Protection Act. So municipalities are in charge of the industrial and agricultural polluters. The smaller municipalities with less than 5000 inhabitants normally do not function as efficient due to the lack of advanced technical issue dealing. (Andersen &Jorgensen, 1995 p:226)

The general mood of decentralization was effectively applied in the environmental organization and strongly backed by effective lobbying from the two associations organizing municipalities and counties. The industry, being the main target of environmental regulation in the private sector, also supported a decentralized administrative structure. The result was that environmental policy would mainly be implemented at county and local levels and central regulations would mainly take the form of guidelines as opposed to binding regulations. (Christiansen, 1996 p: 47)

Denmark is the only EU country that has a high court of the environment: The Environmental Appeal Board. The establishment of this institution in 1974 resulted from industrial concerns that the Environmental protection agency would otherwise become so powerful. Its rulings are final and decisive for the administration of lower levels of government. The appeal board consists of experts nominated by interest organisations (industrial, agricultural and other) and by environmental protection agency. (Andersen, 1997 p: 264)

This is a special fragment of Danish environmental policy that shows power of industries in Denmark. In 1989, the right to complain to Environmental board is restricted to make environmental policy more effective.[18]

A key element in Danish policy making is the corporatist system of decision making .Major interest organizations are closely involved in negotiation s for the drafting of legislation as well as in the subsequent implementation. The most important organizations representing groups targeted by legislation are the federation of Danish industries and the Agriculture Council of Denmark. (Andersen, 1997 p: 260)

The Dansk industry is normally the most important partner for the environmental authorities when drawing up new legislative proposals. It is quite influential during the implementation stage when actual guidelines are drawn up. The Agriculture Council of Denmark comprise of three independent organizations of farmers: the Danish farmer's Union, the Danish family farmers 'Union and the Danish Commercial farmers 'Union. Historically, the agriculture council has been more opposing to the idea of pollution control. In 1973, the agriculture council demanded economic compensation for pollution control requirements. (Andersen, 1997, p: 262)

Today despite its opposition, agriculture has become subject to more detailed environmental regulation.

6.2 Denmark and Nordic Countries

Historically, Denmark's profile in international environmental policy has been less pronounced than Norway's and Sweden's, but it is becoming more communicative .One reason for Denmark's lower international profile could be that Denmark has been less exposed to Trans frontier pollution than its Nordic neighbours. (Andersen, 1997 p:271)

[18] Miljøministeriet, 1989

The Nordic countries have very different natural endowments. Sweden, Norway, and Finland are relatively large countries of 450.000, 324, 000, and 338,000 km2 respectively. They have large areas only fit for extensive economic exploitation. Denmark is much smaller, 43,000km2 and is more or less fully cultivated. They were all late industrialists, but developed very different industrial structures. Finnish, Norwegian, and Swedish industry are all dominated by a number of large firms in heavy industry, while the Danish structure is characterised by the absence of such firms.
(Christiansen, 1996, p: 45)

Other than the small size of the Nordic countries' population, they are also limited in their natural resources. But still, they have generated so many giant companies. Finland alone has two out of five of the world's biggest paper manufacturers.Norsk hydro, Veritas, Nordea, ABB, Ericsson, Nokia, Fortum, Marimekko- these and many have become the household names well beyond the Nordic area.(Bailes, 2004)

One of the specificities of the Nordic countries is the strength of the local level. Much of the concrete action involved in the building of society takes place at the municipal level.
(Persson, 2002p:6)

All Nordic countries have very similar political systems, but their administrative traditions and systems diverge. (Christensen, 2005 p: 20)
The decentralized environmental administrations seem to work well despite a number of implementation problems. This is due to their learning, adaptation to local considerations and they promote aspects of legitimacy. Local and regional units have the capacity to perform complicated tasks connected with environmental administration, control and inspection. (Christiansen, 1996 p: 47)

Finland Specialized Centralized	Specialized Decentralized Denmark
Centralized Integrated Sweden	Decentralized Integrated Norway

Figure 6.2a

Decentralization is the transfer of authority and power in planning, management, and decision-making from higher to lower levels of organizational control. A critical dimension of decentralization is the degree of continued supervision from the state. Since both strategic policy making and responsibility for overall outcomes remains a national government priority. (Bankauskaite et al, 2004)

The degree of public influence at the decentralised level is high in Denmark due to direct elections for county councils. In Finland the public has influence on municipalities through direct elections. The formal democratic influence is even less in Norway where direct political representation is now only found at the national level while regional management is without political representation.

Decentralization

POSITIVE OUTCOMES	NEGATIVE OUTCOMES
Can better fulfil local needs (Mills et al, 1990)	Local groups may oppose national policies
Potential to lead to greater community-financing &Involvement in the decision-making process	Local officials frequently change (leaving newcomer uninformed)
more democratic system (Bankauskaite et al, 2004) (local people control major decisions)	Local officials tend to resist all efforts to close redundant institution (loss of jobs and revenues)

Table 6.2.b

A dominating organizational principle is specialization in Denmark and Finland.. From parliament all the way down to municipal level, special commissions and administrations were established to take control of environmental questions. .
A central reason why things do work in Nordic countries is the rule –deferential" political culture in which most firms and consumes obey rules despite "soft" implementation practises. Cooperative consensual style of regulation requires a delicate balance between integration and the necessity of some kind of a state autonomy.

6.3 Innovation in Denmark and Nordic countries

Nordic countries have always been quick to adopt new technologies. In Northern Europe, natural living conditions have been hard. People are used to coping with long distances and cold winters. They needed every solution possible to save energy and maximize their innovative ability to keep up contacts with each other. The Nordic countries have, for centuries, understood the importance of open access to information. People in the Nordic countries have shared the social and cultural heritage of democracy, welfare and a high level of education. This has formed the basis for a creative and critical public for technological innovations and production. A high level of education has also facilitated the marketing and implementation of the new technology. (Koivonen, 2005)

The Nordic countries have a lot in common, geographically and historically. All Nordic countries are affluent, industrialised with generous welfare support, well-developed social policies, high educational levels, responsible justice systems and stable democracies. (Koch, 2004) However, it would be misleading to take for granted that these similarities should be the foundation for identical innovation policy.

All Nordic countries are having small and medium sized companies. But especially, Sweden and Finland have large, multinational, companies that strongly influence their national innovation performance. The R&D investments of companies like NOKIA, Ericsson, Volvo and ABB helps them to score as regards to national R&D-investments as a proportion of GDP.

Norway on the other hand has a business sector controlled by small enterprises in raw material based industries that do not normally invest much in R&D. (Bailes, 2004)

Sweden relies on the universities and colleges to perform non-company R&D while the Finnish policy makers put great emphasis on basic, long-term research. The policies of Sweden, Finland and Denmark continue to be strongly focused on the need to build new “high-tech” industries and on the role of university science. On the other hand, Policy makers in Norway tend to focus more on innovation in “low tech” industries. (Koch, 2004)

Denmark has an extremely efficient innovation system, with a low input, in terms of innovation costs for innovative firms, as well as a moderately low investment in R&D, as demonstrated by the GERD index.(Maurissen, 2003) The Gerd Index shows the national public and private investment in research and technological development. At the same time, Danish outputs, in terms of turnover created by new products, is extremely high. Similarly, Denmark has a low level of R&D in the economy. Denmark scores lower in terms of R&D investments. (Table6.3) However it has proportionally more innovative companies than Sweden, in the manufacturing sector and in the business sector as a whole.
(Koch, 2004)

The strength of the Danish innovation system is a high level of skills among process operators in Danish firms. What is more, they share their experiences in locally embedded networks of craftsmen and industrial operators. This is enhanced by training programs, often organized with union – employer cooperation. (Edquist and Lundvall, 1993) Another important factor is the deep cultural knowledge of consumer market tastes, which enables Danish firms to maintain a high level of consumer product innovations. On top of that, the Danish industrial groups are very well organized, with institutions and several layers of specialized supporting industries. (Lundvall, 1994).Additional strength is geography: Denmark’s closeness to European consumer market .Moreover Denmark has developed channels to access to Europe. It is not difficult to understand that Denmark has been going extremely well lately, in terms of economic achievements (Asheim & Mariussen, 2003)

Furthermore, in 2003 the Danish Government introduced a Knowledge Strategy, a plan for redesigning the Danish knowledge system. By that plan, the Government commits itself to create optimal conditions for investments in knowledge and reforming the public knowledge institutions. Investments in knowledge are believed to pay off and private companies should invest in knowledge. Knowledge is seen as the only road to increased competitiveness. (Koch, 2004)

National Investments in R&D as a proportion of GDP 2001

Sweden	**4.3%**	**40%**
Finland	3.4%	44%
Iceland	3.0%	49%
Japan	3.0%	
USA	2.8%	
Denmark	**2.4%**	**50%**
Norway	1.6%	36%

Source OECD statistics **Table 6.3** Source: Community Innovation Survey

CHAPTER7
CONCLUSION AND DISCUSSION

Environmental indicators are not designed to provide a full picture of environmental issues, but rather to help reveal trends and draw attention to the phenomena. Indicators are thus only one tool for evaluation, scientific and policy-oriented interpretation is required for them to acquire their full meaning. So Denmark's low performance in ESI can never declare that Danish sustainability experience is unsuccessful. But compared to its Nordic neighbours, Denmark consistently scoring lower in ESI. (Tables can be seen in section 2.4).It would be nice to pin down the exact driving forces behind those political decisions that placed Denmark to that level.

After studying the variables in ESI meticulously and literature study on Denmark, it is easy to see current environmental state of Denmark is shaped by some political decisions and priorities that are set by the previous governments. Agriculture had played a domineering role in Danish environmental history until 1960.The export of agricultural products was the utmost important activity for bringing currency to the nation. Everything possible was therefore done to expand production. Lakes were dried out, streams straightened or diverted into pipes. The groundwater level fell and polluted with surplus phosphorous and nitrate from the surrounding fields. Just recently only 4 % of Denmark's streams ran in their natural courses. Views on agricultural activities in the last decades have changed. But the agriculture still left behind a strong lobby that is very influential in anti-environmental decision-making and polluted environment. Danish farming still provides a good share in exports and uses more effective techniques. But still the subsidies that farming activities are receiving from government is far from having positive effect on environment. When environmental system component and reducing stresses component are examined out of 28 variables, 14 of them are related with farming activities. The Nordic countries except Denmark scoring far better in those components due to their lower agriculture share.

The ESI 2002 index has 68 variables total so 14 out of 68 is a decisive portion in determining the index result of a nation.

Lack of natural resources had directed Denmark to farming activities but this also had a positive influence on Danish environment since all the other Nordic countries being late industrialist are dominated by number of large firms in heavy industry while the Danish structure is characterised by the absence of such firms. Denmark uses coal as the highest energy source in its energy mix (75 %) and this contributes to air pollution.

The Nordic countries have very different natural endowments. Sweden, Norway, and Finland are relatively large countries of 450.000, 324, 000, and 338,000 km2 respectively. They have large areas only fit for extensive economic exploitation. Denmark is much smaller, 43,000km2 and is more or less fully cultivated. From an environmental performance view, this high population density is not favourable. In ESI 2002, there are 4 direct variables that are associated with the population density. High anthropogenic impact on land brings with it many other pollution factors that the indicators or the variables did not address. So in the environmental sustainability track, this characteristic of Denmark is critical.

But at the same time its geographical location provided Denmark a better access to European market when Denmark has to promote its commodities. It's proximity to mainland had facilitated its innovation capacity. Because it was closer to knowledge and information compared to its Nordic neighbours.

Denmark joined EU much before than Finland and Sweden. Its longer membership supplied him with some benefits in environmental policy. The EU membership has made Nordic countries more similar as regards to laws and regulations but still there are important differences in institutional structures. Since Denmark was member longer, it is more familiar with the laws and regulation involving environment. And it is believed that membership in EU generally improves environmental performance due to its strict regulations and accountability. Not a whole big majority of Danes are in favour of EU though.

So this brings up the consensual regime which is balancing different interests by means of compromises and negotiations. Consensual regime is one of effective building block of Danish parliamentary system. In the EU case, some of the EU directives involving environment are not always taken so seriously by the government since the Danish government get into habit of compromises and negotiations within EU as well as in Danish parliament. So when it comes to environmental policy enforcements, compliance to some of the EU directives remains low. Although it is believed longer membership lead to higher compliance level, this belief is not applicable to Denmark.(32 years of membership)

There had always been a dialogue between public and private interests when it comes to environment in the Danish context. Denmark had always been a nation of two political cultures. (Urban and rural cultures.) The urban side of the culture is more individualistic and merchant in nature .On the other hand, the rural side is more collectivist and farmer in nature. Those two extreme poles in the political arena had always been finding middle ground for years. Consensual regime is good in the sense that it is very democratic but at the same time the decisions can never be as effective as they planned to be originally due to the compromises. Especially environmental decisions are multifaceted in nature, so they are complex .It is constructive and informative to see both sides of the story but with the same token, some issues had to be fixed immediately and effectively. The direct action in some cases is more favourable than the roundabout actions.

Denmark’s ideology of commercialization or using market forces helped the environment in looking for new ideas of pollution prevention and cleaner production. The industries perform very efficiently and renewable energy innovations involving wind turbines had always been in progress. So it looks as if Denmark is open to renewable energy technologies and in favour of environmental choices. Yet it can still resist towards bio-fuel arrangement that is recommended by E.U directives. Denmark’s energy share in bio fuel is only 0.2% so it has a room to improve. When marketing the wind turbines, DK is claiming that this type of energy is clean and it does contribute to green houses gases in the atmosphere. It is also recognized that bio fuels as well do not contribute to greenhouses gases in the atmosphere. At the end of the day, green technology is seen as a good commercial commodity for Danish industries

The decentralized structure of Denmark can allow extensive coordination and cooperation among government agencies at all levels and can better full fill local needs but when managing the global commons like marine fisheries, pollution then failures are inevitable. Enforcement power at local governance level (municipalities) is inadequate and weak involving environmental issues. The farmers and pig industries are subsidized in large amounts and their negative contribution to water pollution is substantial. There are many incidences that municipalities are insufficient to cope with the pig farmers. Centralized structures when it comes to enforcement are more effective. According to ESI Index, regulatory rigor of Denmark is very high, but the reality involving environmental issues are different.

Denmark has the potential means to be better in keeping its environment more sustainable. It has a very well functioning democracy, effective public participation, direct involvement of NGO's into policy making, strong local administration, innovative capacity , easy accessibility of information- But still strong lobbies with agendas ,consensual regime, weak enforcement at the local level, high subsidies , its high population density and remains of the past from the farming practises hinders Denmark's further progress.

Such assessments like ESI 2002 can help governments, businesses to shape their national sustainable development. By means of the index, the nations at least have at hand a clear and comprehensive measure. In fact many countries are now using the ESI as a policy guide, according to the ESI report. Mexico, South Korea, the United Arab Emirates, and Belgium have all implemented new policies in response to relatively poor performance on previous rankings.

Although ESI is considered as a crude measurement and oversimplifying environmental issues according to some critiques, still it is capable of capturing Danish contradictions in environmental policy making. I believe that is very interesting. So this might mean this dilemmatic nature of DK has a higher influence on Danish political and environmental decisions than it is known.

CHAPTER8
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1.7.1. APPENDIX A

Explanation of Appendices

1.7.2. APPENDIX B

2001 Environmental Sustainability Index table and 2002 Environmental Sustainability Index table
The results for the environmental sustainability index are presented with all nations that are analyzed.

Source: http://www.ciesin.org/indicators/ESI/downloads.html

1.7.3. APPENDIX C

The aggregation for the energy sector in Denmark
The energy share (%) of each source is presented to give an idea about Danish Energy policy
.
Source: http://externe.jrc.es/

1.7.4. APPENDIX D

Governance indicators for Sweden, Finland, Norway.
The values for the indicators, voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, control of corruption are shown.

Source: Kaufmann D., A. Kraay, and M. Mastruzzi 2005: Governance Matters IV: Governance Indicators for 1996-2004.

1.7.5. APPENDIX E

Protected areas under world heritage program

Source http://www.unep-wcmc.org/index.html?http://www.unep-wcmc.org/protected_areas/data/un_annex.htm~main

1.7.6. APPENDIX F

The number of ISO 14001 certification of the world

1.7.7. APPENDIX G

The global 100 companies

Those are the companies that are having the best chance of being around in 100 years because of their demonstrated performance.

Source: http://www.global100.org/

1.7.8. APPENDIX H

WBSCD member companies

World Business Council for Sustainable Development members.

Source: http://www.wbcsd.org/templates/TemplateWBCSD5/

1.7.9.

1.7.10. APPENDIX I

Global Competitiveness Report 2003-2004, 2004-2005

Public institution index

Technology index

Core technology-innovating economies, 2002

Source: US Patent and Trademark Office, February 2003

1.7.11. APPENDIX B,

1.7.12. Table 1 2002 Environmental Sustainability Index (ESI)

1 Finland 73.9
2 Norway 73.0
3 Sweden 72.6
4 Canada 70.6
5 Switzerland 66.5
6 Uruguay 66.0

7 Austria 64.2
8 Iceland 63.9
9 Costa Rica 63.2
10 Latvia 63.0
11 Hungary 62.7
12 Croatia 62.5
13 Botswana 61.8
14 Slovakia 61.6
15 Argentina 61.5
16 Australia 60.3
17 Panama 60.0
18 Estonia 60.0
19 New Zealand 59.9
20 Brazil 59.6
21 Bolivia 59.4
22 Colombia 59.1
23 Slovenia 58.8
24 Albania 57.9
25 Paraguay 57.8
26 Namibia 57.4
27 Lithuania 57.2
28 Portugal 57.1
29 Peru 56.5
30 Bhutan 56.3
31 Denmark 56.2
32 Laos 56.2
33 France 55.5
34 Netherlands 55.4
35 Chile 55.1
36 Gabon 54.9
37 Ireland 54.8
38 Armenia 54.8
39 Moldova 54.5
40 Congo 54.3
41 Ecuador 54.3
42 Mongolia 54.2
43 Central Af. Rep. 54.1
44 Spain 54.1
45 United States 53.2
46 Zimbabwe 53.2
47 Honduras 53.1
48 Venezuela 53.0
49 Byelarus 52.8
50 Germany 52.5
51 Papua N G 51.8
52 Nicaragua 51.8
53 Jordan 51.7
54 Thailand 51.6
55 Sri Lanka 51.3

56 Kyrgyzstan 51.3
57 Bosnia and Herze. 51.3
58 Cuba 51.2
59 Mozambique 51.1
60 Greece 50.9
61 Tunisia 50.8
62 Turkey 50.8
63 Israel 50.4
64 Czech Republic 50.2
65 Ghana 50.2
66 Romania 50.0
67 Guatemala 49.6
68 Malaysia 49.5
69 Zambia 49.5
70 Algeria 49.4
71 Bulgaria 49.3
72 Russia 49.1
73 Morocco 49.1
74 Egypt 48.8
75 El Salvador 48.7
76 Uganda 48.7
77 South Africa 48.7
78 Japan 48.6
79 Dominican Rep. 48.4
80 Tanzania 48.1
81 Senegal 47.6
82 Malawi 47.3
83 Macedonia 47.2
84 Italy 47.2
85 Mali 47.1
86 Bangladesh 46.9
87 Poland 46.7
88 Kazakhstan 46.5
89 Kenya 46.3
90 Myanmar (Burma) 46.2
91 United Kingdom 46.1
92 Mexico 45.9
93 Cameroon 45.9
94 Vietnam 45.7
95 Benin 45.7
96 Chad 45.7
97 Cambodia 45.6
98 Guinea 45.3
99 Nepal 45.2
100 Indonesia 45.1
101 Burkina Faso 45.0
102 Sudan 44.7
103 Gambia 44.7
104 Iran 44.5

105 Togo 44.3
106 Lebanon 43.8
107 Syria 43.6
108 Ivory Coast 43.4
109 Zaire 43.3
110 Tajikistan 42.4
111 Angola 42.4
112 Pakistan 42.1
113 Ethiopia 41.8
114 Azerbaijan 41.8
115 Burundi 41.6
116 India 41.6
117 Philippines 41.6
118 Uzbekistan 41.3
119 Rwanda 40.6
120 Oman 40.2
121 Trinidad and Tob. 40.1
122 Jamaica 40.1
123 Niger 39.4
124 Libya 39.3
125 Belgium 39.1
126 Mauritania 38.9
127 Guinea-Bissau 38.8
128 Madagascar 38.8
129 China 38.5
130 Liberia 37.7
131 Turkmenistan 37.3
132 Somalia 37.1
133 Nigeria 36.7
134 Sierra Leone 36.5
135 South Korea 35.9
136 Ukraine 35.0
137 Haiti 34.8
138 Saudi Arabia 34.2
139 Iraq 33.2
140 North Korea 32.3
141 United Arab Em. 25.7
142 Kuwait 23.9

Source: http://www.ciesin.org/indicators/ESI/downloads.html

1.7.13. Table 2 2001Environmental Sustainability Index (ESI)

Finland 80.5
Norway 78.2

Canada 78.1
Sweden 77.1
Switzerland 74.6
New Zealand 71.3
Australia 70.7
Austria 67.8
Iceland 67.3
Denmark 67.0
United States 66.1
Netherlands 66.0
France 65.8
Uruguay 64.6
Germany 64.2
United Kingdom 64.1
Ireland 64.0
Slovak Republic 63.2
Argentina 62.5
Portugal 61.4
Hungary 61.0
Japan 60.6
Lithuania 60.3
Slovenia 59.9
Spain 59.5
Costa Rica 58.8
Estonia 57.7
Brazil 57.4
Czech Republic 57.2
Bolivia 56.9
Chile 56.6
Latvia 56.3
Russian Federation 56.2
Panama 55.9
Cuba 54.9
Colombia 54.8
Italy 54.3
Peru 54.3
Croatia 54.1
Botswana 53.6
Greece 53.1
Zimbabwe 52.0
Nicaragua 51.9
Ecuador 51.8
South Africa 51.3
Mauritius 51.2
Venezuela 50.8
Armenia 50.6
Gabon 50.5
Mongolia 50.3
Sri Lanka 49.8
Malaysia 49.7
Israel 49.5
Paraguay 48.9
Fiji 48.1
Central African Republic 48.0
Belarus 48.0

Poland 47.6
Moldova 47.4
Bulgaria 47.4
Guatemala 47.3
Papua New Guinea 47.3
Ghana 47.0
Honduras 46.9
Singapore 46.8
Nepal 46.7
Egypt 46.5
Trinidad and Tobago 46.4
Azerbaijan 46.4
Turkey 46.3
Mali 46.2
Dominican Republic 45.4
Mexico 45.3
Thailand 45.2
Bhutan 45.1
Cameroon 44.9
Mozambique 44.2
Albania 44.2
Belgium 44.1
Romania 44.1
Uganda 44.0
Kenya 43.9
Tunisia 43.7
El Salvador 43.7
Pakistan 43.6
Indonesia 42.6
Senegal 42.5
Jamaica 42.3
Morocco 41.9
Uzbekistan 41.6
Kazakhstan 41.6
Malawi 41.3
India 40.9
Tanzania 40.3
South Korea 40.3
Jordan 40.1
Zambia 39.8
Kyrgyz Republic 39.6
Bangladesh 39.5
Macedonia 39.2
Togo 39.1
Algeria 38.9
Benin 38.6
Burkina Faso 38.6
Iran 38.4
Syria 37.9
Sudan 37.7
China 37.6
Lebanon 37.5
Ukraine 36.8
Niger 36.5
Philippines 35.7

Madagascar 35.4
Vietnam 34.2
Rwanda 33.5
Kuwait 31.9
Nigeria 31.8
Libya 31.3
Ethiopia 31.2
Burundi 30.1
Saudi Arabia 29.8
Haiti 24.7

Source: http://www.ciesin.org/indicators/ESI/downloads.html

APPENDIX C

SUMMARY OF AGGREGATION RESULTS

Energy mix	GWh/year	%
Coal	70,825	75%
Natural Gas	9,965	10
oil	3,140	3
wind	1,1180	1.2
orimulsion	5,575	6
Biomass/waste	3,950	4.2
Biogas	195	0.2
Other renewables	58	0.1
Total for aggregation	85,305	89.4

1.7.14. Damages by pollutant	1.7.15. Ecu/t of pollutant			
	NOx	SO2	CO2	OZONE

Coal &oil	3755	4216	3.8-139	1500
Natural gas	4728	-	3.8-139	1500
wind	-	-	-	-
Biogas	4830	4400	3.8-139	1500

Aggregated Damages using different CO2 monetisation values(Ecu/T CO2)	**ECU /YEAR (3.8)**	**ECU/YEAR (18)**	**ECU/YEAR (46)**	**ECU/YEAR (139)**
Coal &Oil	1415	1767	2462	4768
Natural Gas	45	72	129	319
Wind	0.69	0.92	1.4	3.0
Biogas	0.76	0.76	0.76	0.76
Total	1461	1841	2593	5091

Source: http://externe.jrc.es/

APPENDIX D

Statistical Table 1: All 6 governance indicators for DENMARK

Governance Indicator	Year	Percentile Rank (0-100)	Estimate (-2.5 to + 2.5)	Standard Deviation	Number of surveys/ polls
Voice and Accountability	2004	100.0	+1.59	0.16	10
	2002	100.0	+1.72	0.17	10
	2000	96.9	+1.51	0.21	7
	1998	97.9	+1.51	0.23	5
Political Stability	2004	89.8	+1.21	0.19	12
	2002	90.8	+1.26	0.20	9
	2000	94.5	+1.45	0.23	9
	1998	91.5	+1.40	0.24	6
Government Effectiveness	2004	98.6	+2.15	0.17	10
	2002	96.5	+2.05	0.16	9
	2000	94.6	+1.84	0.19	8
	1998	97.3	+2.13	0.25	6
Regulatory Quality	2004	97.0	+1.76	0.21	8
	2002	97.4	+1.74	0.18	7
	2000	93.6	+1.41	0.29	5
	1998	95.1	+1.40	0.23	5
Rule of Law	2004	97.1	+1.91	0.13	12
	2002	98.0	+1.93	0.13	12
	2000	93.6	+1.95	0.16	11
	1998	95.1	+1.99	0.19	9
Control of corruption	2004	98.0	+2.38	0.14	11
	2002	98.5	+2.25	0.15	9
	2000	97.3	+2.38	0.18	9

Source: Kaufmann D., A. Kraay, and M. Mastruzzi 2005: Governance Matters IV: Governance Indicators for 1996-2004.

Statistical Table 2: All 6 governance indicators for SWEDEN

Governance Indicator	Year	Percentile Rank (0-100)	Estimate (-2.5 to + 2.5)	Standard Deviation	Number of surveys/ polls
Voice and Accountability	2004	99.0	+1.52	0.16	9
	1998	96.9	+1.48	0.23	5
Political Stability	2004	93.2	+1.38	0.19	11
	1998	95.8	+1.51	0.24	6
Government Effectiveness	2004	94.7	+1.92	0.17	10
	1998	94.5	+1.97	0.25	6
Regulatory Quality	2004	92.1	+1.54	0.21	8
	1998	87.5	+1.14	0.23	5
Rule of Law	2004	96.6	+1.85	0.13	12
	1998	94.1	+1.95	0.19	9
Control of Corruption	2004	97.5	+2.20	0.14	10
	1998	97.8	+2.55	0.18	8

Source: **Kaufmann D., A. Kraay, and M. Mastruzzi 2005: Governance Matters IV: Governance Indicators for 1996-2004.**

Statistical Table 3: All 6 governance indicators for FINLAND

Governance Indicator	Year	Percentile Rank (0-100)	Estimate (-2.5 to + 2.5)	Standard Deviation	Number of surveys/ polls
Voice and Accountability	2004	98.5	+1.50	0.16	9
	1998	97.9	+1.51	0.23	5
Political Stability	2004	99.0	+1.65	0.20	11
	1998	99.4	+1.60	0.24	6
Government Effectiveness	2004	97.6	+2.06	0.17	9
	1998	95.1	+2.02	0.25	6
Regulatory Quality	2004	98.0	+1.79	0.21	8
	1998	96.2	+1.51	0.23	5
Rule of Law	2004	98.6	+1.97	0.13	11
	1998	97.3	+2.06	0.19	9
Control of corruption	2004	100.0	+2.53	0.15	10
	1998	97.8	+2.55	0.18	8

Source: Kaufmann D., A. Kraay, and M. Mastruzzi 2005: Governance Matters IV: Governance Indicators for 1996-2004.

Statistical Table 4: All 6 governance indicators for NORWAY

Governance Indicator	Year	Percentile Rank (0-100)	Estimate (-2.5 to + 2.5)	Standard Deviation	Number of surveys/ polls
Voice and Accountability	2004	99.5	+1.53	0.16	9
	1998	99.5	+1.55	0.23	5
Political Stability	2004	98.1	+1.53	0.20	11
	1998	97.0	+1.52	0.24	6
Government Effectiveness	2004	96.2	+1.97	0.17	9
	1998	96.2	+2.08	0.25	6
Regulatory Quality	2004	90.6	+1.33	0.21	8
	1998	93.5	+1.25	0.23	5
Rule of Law	2004	98.1	+1.95	0.13	11
	1998	98.9	+2.21	0.19	9
Control of Corruption	2004	96.1	+2.11	0.15	10
	1998	95.6	+2.35	0.18	8

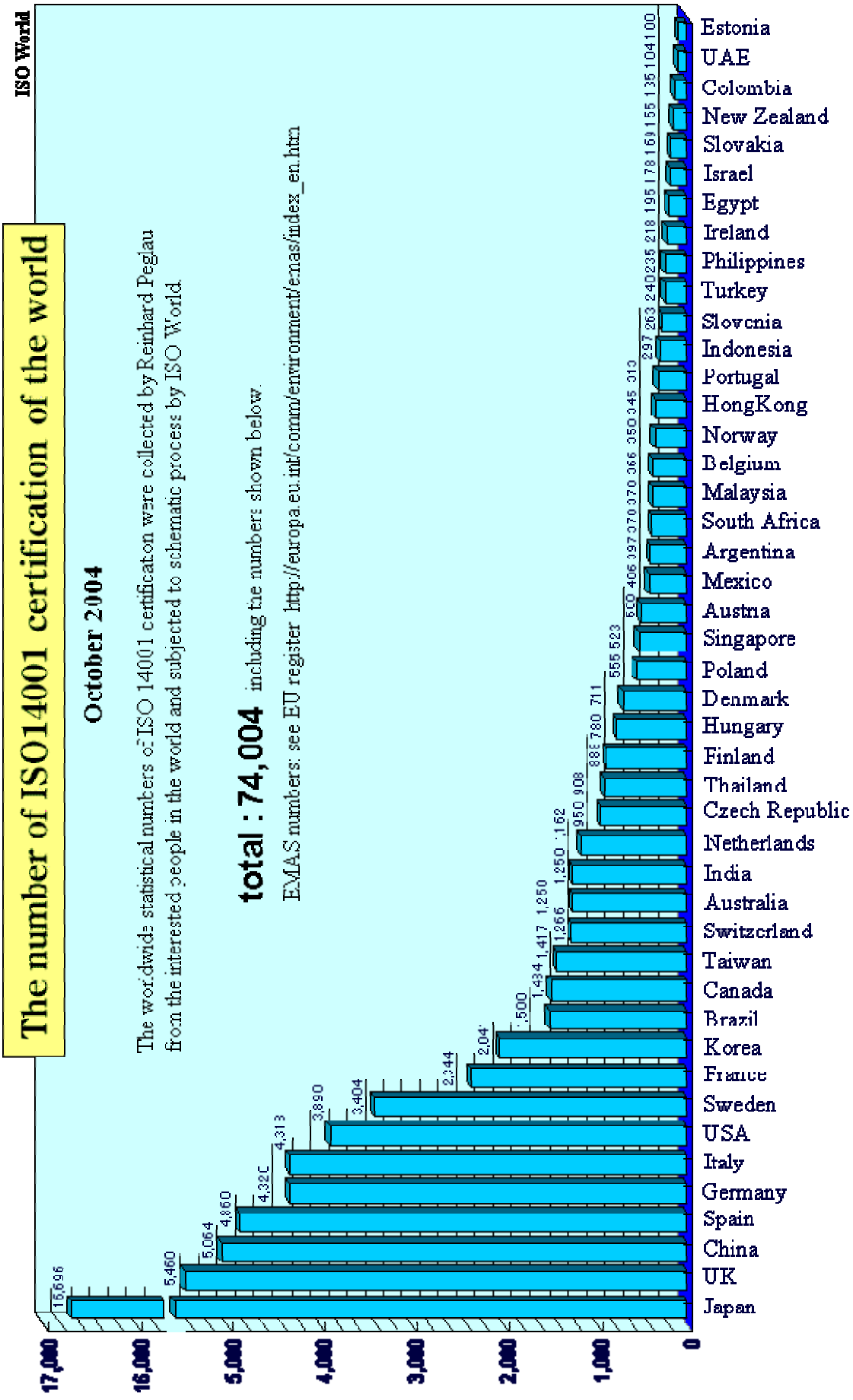
Source**:** Kaufmann D., A. Kraay, and M. Mastruzzi 2005: Governance Matters IV: Governance Indicators for 1996-2004.

APPENDIX E

ALL PROTECTED AREAS RECORDED IN THE UNEP-WCMC PROTECTED AREAS DATABASE

Country	Area	Total area protected	% of protected area
Denmark	43,075	13,796	32
Denmark +Greenland	2,175,600	982,500	45.2
Sweden	440,940	36,547	8.3
Finland	337,030	28,407	8.7
Norway	323,895	20,865	6.4

Sourcehttp://www.unepwcmc.org/index.html?http://www.unepwcmc.org/protected_areas/data/un_annex.htm~main


ISO World
The number of ISO14001 certification of the world
October 2004
The worldwide statistical numbers of ISO 14001 certificaton were collected by Reinhard Peglau
from the interested people in the world and subjected to schematic process by ISO World.
total : 74,004 including the numbers shown below.
EMAS numbers: see EU register http://europa.eu.int/comm/environment/emas/index_en.htm
17,000
16,000
5,000
4,000
3,000
2,000
1,000
0
Japan
UK
China
Spain
Germany
Italy
USA
Sweden
France
Korea
Brazil
Canada
Taiwan
Switzerland
Australia
India
Netherlands
Czech Republic
Thailand
Finland
Hungary
Denmark
Poland
Singapore
Austria
Mexico
Argentina
South Africa
Malaysia
Belgium
Norway
HongKong
Portugal
Indonesia
Slovenia
Turkey
Philippines
Ireland
Egypt
Israel
Slovakia
New Zealand
Colombia
UAE
Estonia

AP

APPENDIX G

The Global 100 are sustainable in the sense that they stand the best chance of being around in 100 years because of their demonstrated performance and strategic ability to manage the triple bottom line (society, environment, and economy).[19]

Denmark

Company Name	Sector
VESTAS WIND SYSTEMS A/S	Electrical Equipment
Novo Nordisk	Pharmaceuticals

Norway

Company Name	Sector
Tomra Systems Asa	Industrial Machinery

Finland

Company Name	Sector
Nokian Renkaat	Auto Components
Nokia Oyg	Communications Equipment
KESKO	Food & Drug Retailing

[19] http://www.global100.org/

Sweden

Company Name	Sector
FoereningsSparbanken AB	Banks - Europe
Ericsson	Communications Equipment
Skanska	Construction & Engineering
VOLVO	Construction & Farm Machinery
Electrolux AB	Household Durables
Svenska Cellulosa AB	Paper & Forest Products
Hennes & Mauritz	Specialty Retail

APPENDIX H

WBSCD member companies

DENMARK	SWEDEN	FINLAND	NORWAY
Borealis	Skandia Insurance	Fortum	Det Norske Veritas
Brødrene Hartman	Skanska	Metsäliitto Group	Leif Höegh
Novo Nordisk	Stora Enso	UPM	Norsk Hydro
Novozymes		Nokia	Norske Skogindustrier

			Statoil Storebrand

Source: http://www.wbcsd.org/templates/TemplateWBCSD5/

APPENDIX I

Global Competitiveness Report 2003-2004-2005

Country Rankings 2004-2005	Country Rankings 2003-2004
1.Finland	1.Finland
2.USA	2.USA
3.Sweden	3.Sweden
4 Taiwan	4Denmark
5Denmark	5Taiwan
6Norway	6Singapore
7Singapore	7 Switzerland
8Switzerland	8 Iceland

Public institution index

Rank	Country name	Score
1	Denmark	6.59
2	Iceland	6.58
3	Finland	6.48
4	New Zealand	6.41
5	Norway	6.35

6	Sweden	6.31

Technology index

Rank	Country name	Score
1	United States	6.24
2	Taiwan	6.04
3	Finland	5.92
4	Sweden	5.80
5	Japan	5.68
6	Denmark	5.34
7	Switzerland	5.25
8	Israel	525
9	Korea	5.18
10	Norway	5.17

Core technology-innovating economies, 2002

Average annual US utility patents granted

Country per million population Rank

Rank	Country name	Score
1	United States	301.48
2	Japan	273.40
3	Taiwan	241.38
4	Sweden	190.34
5	Switzerland	189.44

6	Israel	165.08
7	Finland	155.58
8	Germany	137.52
9	Canada	109.62
10	Singapore	97.62
11	Luxembourg	82.59
12	Denmark	80.38
13	Korea	79.87
14	Belgium	70.10
15	France	67.59
16	Austria	65.43
17	United Kingdom	64.29
18	Norway	53.78

Source: US Patent and Trademark Office, February 2003