

**THE NORWEGIAN MODEL OF SUSTAINABLE
DEVELOPMENT.
A POLICY ORIENTED CAPITAL FRAMEWORK
FOR MEASUREMENT AND POLICIES**

PREFACE

A number of European countries have recently presented national strategies for sustainable development. This was e.g. done by Norway in 2003, National Agenda 21 (NA 21), Switzerland in 2004, the UK in 2005 and by Sweden in 2006.

The longer term challenges of sustainable development are basically global. However, around two thirds of global GDP is produced in developed (OECD) countries, and many policies for handling the future challenges of sustainable development are still largely the responsibility of nation states. At the same time, the present stock of green house gas emissions (GHGs) is largely caused by the same countries. While we should strive to further develop regional and global solutions, national strategies and policies to enhance sustainable development if real and effective will contribute to sustainable development globally.

As a contribution to the ongoing work on national strategies, and in order to learn from each other and to strive for "good practice", I present the conceptual framework for the Norwegian strategy, and how this is used for measurement and policy formulation- including the governance structure.

The present Norwegian government which took office in October 2005, is now using the same policy oriented capital framework in order to present their long term strategy for sustainable development in The Norwegian National Budget for 2008.

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EXECUTIVE SUMMARY

In an age of globalisation, which may continue for the foreseeable future, the challenges of future developments and its longer term sustainability are basically global ones. Large and populous countries like China and India have been growing rapidly for some time, and other parts of Asia and Latin America are increasing their production more rapidly than most OECD countries. These processes are now better understood and welcomed by many as material welfare per capita is spreading, although with notable exceptions. At the same time threats as to whether present developments can be sustained, such as the build up of the stock of Green House Gases (GHGs) in the atmosphere, and loss of natural capital beyond critical levels (biodiversity), are increasingly acknowledged. Global mechanisms and policies are necessary to secure long term sustainable development, i.e. a development path in which material welfare per capita can be enhanced without ruining or severely damaging the global environmental commons.

As of now, even if some global agreements are in place, many policy measures that influence development processes are the responsibility of nation states. National policies to enhance sustainable development therefore seems both useful and necessary to reduce the risks of future threats to global sustainability. A main responsibility in this regard rests with developed (OECD) countries which in most cases have reached high levels of GDP per capita while being mainly responsible for the present stock of GHS globally. A number of European countries have recently established Sustainable Development Strategies to guide longer term policies in sustainable directions. Norway established such a strategy in 2003 which subsequently was endorsed by the Parliament.

In Norway the challenge of sustainable development is seen as an integral part of longer term development policies, which inter alia grows out of neoclassical growth theory including recent additions and modifications. Development is driven by real or man made capital, natural capital, human capital, social and political institutions and how well they function (governance) and technological developments. The main types of capital or a country's total resource base is defined by national statistical agencies and conventions as that country's National Wealth providing welfare services (utility) to its population.

The question of whether the total resource base per capita can be sustained for the coming generation(s) depend on:

- Whether the present generation is willing to give up something today or buy insurance against future threats to sustainability;
- The seriousness of these future threats (climate change, biodiversity etc.).

Assessments of future sustainability are carried out in several steps in Norway. First, one estimates National Wealth per capita and how this total resource base per capita develops over time. It has been going up consistently in Norway, and as such these estimates indicate sustainability. It is important to remember in this connection that only real and natural capital are estimated directly leaving us with a large residual, and that important natural/environmental components - those that are not directly and indirectly traded in markets - are not incorporated. That is why one in addition needs more sustainable development indicators, SDIs, for a fuller and more detailed assessment of future threats.

Thus the next step is to develop a core set of SDIs, mostly measured in physical terms, to assess sustainability in the major policy areas. Presently there are 18 such indicators updated regularly by Statistics Norway based on the capital approach to development proposed by the Norwegian Sustainable Indicator Commission in 2005.

Market based natural capital is presently some 12 per cent of Norwegian National Wealth given our stock of non-renewable (oil and gas) and semi-renewable (fish) natural resources. The income from the extraction and sale of petroleum, which adds to measured GDP according to present accounting conventions, is channelled into The Central Government Pension Fund-Global, and invested entirely abroad in foreign

stocks and bonds. Thus one type of capital is transformed into another, financial assets abroad. And thus the stock of capital is maintained for future generations of Norwegians, as only the estimated average return per year, 4 per cent, is used for domestic purposes as the stock of capital in the Fund is growing rapidly. This illustrates that while capital stock estimates are necessary and useful SDIs, GDP is not. One could boost GDP growth in Norway in the short term by rapidly using up non-renewable petroleum resources, but that would not be sustainable if not used for building up other types of capital. GDP is therefore not an indicator of sustainable development. The Norwegian fiscal rule for use of natural resources follows the so called "Hartwick rule" presented in the economic literature 30 years ago.

The governance structure of The Norwegian Model of Sustainable Development is:

- The Minister of Finance is politically responsible for the National SD Strategy. She is aided by a group of State Secretaries chaired by The Ministry of Finance in coordinating long term development policies;
- Statistics Norway is responsible for regularly updating and presenting National Wealth estimates and the national core SDI set.

A revised national sustainable development strategy, based inter alia on this conceptual and practical framework for measurement and policies, will be presented in The National Budget 2008.

I: INTRODUCTION

1 Introduction

The World Commission on Environment and development, WCED, Our Common Future (1987) created much political interest in sustainable development, and much work has been carried out since the Rio Conference in 1992.

However, work on the forces driving development started more than 200 years earlier with the publication of Adam Smith's seminal work: "An Inquiry into the Nature and Causes of the Wealth of Nations" (1776). The notion of wealth or capital was introduced, and another famous classical economist, Ricardo, focused inter alia on one form of natural capital, namely land.

A rigorous treatment of savings and investments, crucial elements in longer term development, was presented by Ramsey in 1928. John Hartwick discussed rules for effectively using natural resources as part of sustainable development processes in 1977.

A point of departure of The Norwegian National Sustainable Development Strategy, is a theoretical or conceptual framework for development based on capital. The forces driving development are the main categories of capital: produced, human, natural and social combined with population and technological developments. This is elaborated upon in sections II and III.

In section IV an overview of the application of this framework in Norway is given, and in section V some possibilities for improvements and further work is suggested.

Computation of a nation's total resource base or National Wealth (NW) is fairly standard procedure for national statistical agencies. The method used by Statistics Norway is briefly described in Appendix 1.

Evaluation of NW per capita at separate points in time is a starting point for evaluating challenges to national sustainability. National Wealth per capita in Norway increased from less than 5 million Norwegian kroner, (NOK), in 1985 to between 6 and 7 million NOK per capita in 2001. For reasons elaborated upon in this paper, one needs in addition more detailed sustainable development indicators (SDIs) – often measured

in physical terms – for a more complete evaluation of sustainability. The next step is thus to examine the core set of indicators. The 18 SDIs are arrived at from the policy oriented capital framework. I.e. the main resource or capital components real or produced capital, natural capital and human capital (which in our case includes social aspects). In appendix 2 the use of the 18 SDIs is presented in more detail, and in appendix 3 some other measurement approaches are described.

II: CONCEPTUAL FRAMEWORK

II-1 Development Theories: Main Forces Driving development

As already alluded to, the concepts of wealth and capital as a basis for development and welfare go back to Adam Smith and David Ricardo, *op.cit.* Malthus elaborated on the role of population. According to John Hicks, these were the first development or growth theories, see: "Capital and Growth" (1965), chapter 4.

To achieve development over the longer term, one must save in order to invest. The first rigorous treatment of this key question for (sustainable) development was presented in Frank Ramsey's article: "A Mathematical Theory of Saving" (1928).

Economic Nobel prize winner Robert Solow revived interest in classical growth theory in the 1950s, and he sums up his work on neoclassical growth theory in his book: "Growth Theory: An Exposition" (1988) formalising production functions or growth equations explaining the forces driving development.

The notion of human capital was introduced in the literature by T.W. Schultz and Gary Becker in the 1960s. In Romer's models of endogenous growth of the 1980s, human capital was seen as an important element in understanding development, as was (endogenous) technological change.

The OECD Growth Study (2003) documents empirically (inter alia through regression analyses) the importance of education and human capital for (economic) development.

The role of natural resources or natural capital, NC, has perhaps been intuitively understood for a long time and, as mentioned, figured prominently as a factor of production in Ricardo's works 200 years ago. Some 30 years ago John Hartwick published the article: "Intergenerational Equity and the Investing of Rents from Exhaustible Resources" (1977). *American Economic Review*, 67:972-4.

For a fairly recent survey of this literature, see Atkinson, Dubourg, Hamilton, Muriasinghe, Pearce and Young: "Measuring Sustainable Development. Macroeconomics and the Environment" (1997).

Pearce and Atkinson introduced the concept of weak sustainability (WSD) in their article: "Capital Theory and the Measurement of Sustainable development: An Indicator of Weak sustainability" (1993). *Ecological Economics*, 8:103-8. WSD is a rule specifying that the overall capital stock per capita, or NW per capita, does not decline over time. Substitution between the various stocks of capital is possible. This links to neoclassical growth theory which assumes that the elasticity of substitution is positive (unity in Cobb-Douglas production functions).

Strong sustainability, SSD, assumes that substitution is limited, and that there is a minimum requirement for maintenance of (critical levels) e.g. the natural capital stock, NC.

II-2 Measurement

The Keynesian macroeconomic framework was the main conceptual basis for national accounting as it emerged after World War II. SNA from 1993 is now the basis for macroeconomic policies, and work is ongoing to refine this framework. It is beyond the scope of this paper to elaborate on the shortcomings of (short term) national accounting and its relevance for (measuring) longer term developments in utility or social welfare.¹ However two important shortcomings regarding longer term developments are:

-Total value added or GDP does not take into account the natural resources used up in the processes of creating value added. Consequences for the Norwegian case is elaborated in section IV-1 below.

-Resources spent on education are recorded as an expense, while investment in education wisely spent boosts human capital and possibilities for future (sustainable) development, see e.g. OECD (2003).

Work in Norway has been going on since the 1970s to supplement traditional national accounts. Resource accounting was a major project carried out by Statistics Norway in the 1980s, see Alfsen et.al. (1987). Resource accounts, while less elaborate than originally envisioned, is still the base for market based natural capital estimates in Norway. See appendix 1.

International work in this area has since then been carried out under the auspices of the UN, see SEEA (2003).

As mentioned above, the important role of human capital was introduced in the 1960s. Yet no similar international efforts have to my knowledge been carried out to directly measure this capital category as it in most National Wealth estimates is computed as a residual. More on the Norwegian practice below.

A lot of work on social indicators was carried out by the OECD and others in the 1970s, largely without a conceptual framework. The World Bank discusses economic and sociological aspects of social capital in Dasgupta and Seralgeldin ed.: "Social Capital. A Multifaced Perspective" (2000). While not discussing social capital explicitly, D'Ercole and Salvini suggest in their paper: "Towards Sustainable Development: The Role of Social Protection" OECD (2003) how key social protection systems and institutions matter for sustainable development, and how it can be measured through indicators.

Last but not least, The World Bank in their recent publication: "Where is the Wealth of Nations? Measuring Capital for the 21st Century" (2005) published genuine savings (GS) estimates for 140 countries in 2003. Just over 30 were estimated to have negative savings. To compute genuine savings, GS, estimates, The World Bank includes expenditures on education in their definition of savings.

This is in principle the same policy oriented capital approach to measurement and policies for sustainable development as the one adopted in the Norwegian model. GS is in principle the difference between total resource stocks or NW at different points in time. In practice The World Bank GS computations are simplifications due to data limitations, yet such estimates for 140 countries give a good indication of whether these countries save enough to sustain present development trends, or whether negative genuine saving pose a threat to sustainable development. Implications for policy making is also elaborated upon by The World Bank.

¹ See Boarini, Johansson and d'Ercole: "Alternative Measures of Well-Being". OECD Economics Department Working Papers No. 476.

III SUSTAINABLE DEVELOPMENT AND THE MANAGEMENT OF NATIONAL WEALTH

III-1 The concept of sustainable development

In section II it was argued that:

- Development is driven by various forms of capital, demographic forces and technological change.
- One needs measures of not only traditional man made capital (real and financial) but also measures (ideally through non-market accounts) for other types of capital (human and natural).

We therefore have a conceptual framework to better understand the forces driving development and for measurement.

The term sustainable means "ending" or "lasting". So sustainable development is development that lasts². It thus seems reasonable to interpret sustainable development as developments that can continue "for ever", or at least until the end of the time horizon, e.g. the next generation, considered by long term policy. In addition, developments in question should have a positive quality; to deserve the term sustainable, the situation should not deteriorate. However, whether a given development is good or bad may be more difficult to judge and agree on. In the professional economic literature it is usual to define sustainable developments as developments where the level of welfare, or living standards per capita broadly defined, are not decreasing over time.

III-2 National wealth as a basis for welfare: A policy oriented capital approach

The question whether development is sustainable depends on whether it is possible to say something about developments over time since "the needs of today shall be met without inflicting damage to the next generation," WCED (1987). It is evident that this is a demanding condition, and in Norway we have a less ambitious starting point, focused on *potential* future developments rather than trying to predict what the actual developments will be. In other words, it is asked: what is the (best) future welfare development we can expect to achieve given the present day starting point? This question draws the attention to what *resources* we have at our disposal today, and towards the issue whether we manage these in ways that make it possible to maintain and further develop the resource base over time. The basis for this interpretation of potential sustainability is the assumption that our welfare is produced by nature and human beings, using services from a resource or capital base. This conceptual point of departure should be uncontroversial.³

In this context resources must be understood in a broad sense. They cover not only traditional economic resources in the form of money (financial capital) and real assets (produced capital goods) such as machines, buildings and other production equipment. They also include natural resources such as non-renewable mineral-, petroleum resources, and (conditional) renewable natural resources such as forests, fish, hydro power, wind power, etc. In addition, environmental resources provide a wide variety of services as well as cleaning services helping to provide air, water and soil of good quality; and, not least, human beings depend in a fundamental manner on the earth's continuing functioning as a basic ecological system. Human resources, or human capital, provide labour, competence and knowledge of great value for our welfare. Finally, some prefer to define social capital or social resources in the form of networks and suitable organisation of society as a separate resource category. However, the level of precision of what constitutes social capital is less developed than for other resource components, see i.e. Dasgupta and Stiglitz, 2000. D'Ercole and Salvini (2003) makes a plausible case for the role of social protection systems and institutions

² See Atkinson, Dubourg, Hamilton, Munasinghe, Perce and Young, op.cit, page 3

³ This follows from the conceptual framework sketched in Section II above, and it is also the point of departure in The World Bank Publication: "Where is the Wealth of Nations? Measuring capital for the 21st Century". Washington 2005.

and the way they work (governance). Thus, in Norway we have – as elaborated on in IV-I and appendix 2, included social SDIs in our national core SDI set.

The total resource base is defined by economists, statisticians and accountants as our *national wealth*. Thus, in addition to financial- and real capital, it also includes human capital and natural and environmental resources. These resource components yield a return that directly or indirectly contribute to our welfare. National wealth consists of components that have a market price as well as components producing services not traded in markets. The value of national wealth depends on the welfare effects that the use of its various components *may* yield over time. In other words, the value of national wealth equals the discounted sum of the welfare produced by its various components over time. Since sustainable development assumes that our total welfare per capita should not diminish and, preferably, increase over time, the assessment of whether or not a given development may be called sustainable depends on whether our overall wealth broadly defined increases or decreases.

However, we do not argue that a favourable development of over all national wealth necessarily ensures that sustainable development in fact will take place. Maintenance of our national wealth is therefore only a necessary, but not a sufficient, condition for sustainable development. A stable or growing national wealth nevertheless suggests rather strongly that such a development may be taking place. Conversely, a negative development of national wealth suggests that sustainable development is threatened.

However, and as further elaborated upon in Appendix 1, estimates of NW has its limitations. Only natural capital components directly or indirectly exchanged in markets are counted. Thus additional SDIs for natural capital components not exchanged in markets measured in physical terms are needed and thus included in the national Norwegian core SDI set.

Presently, human capital – the main component in measured NW – is computed as a residual. Thus, we need additional SDIs also in this area.

That should not refrain us from using a developmental capital framework as the conceptual base to look for additional SDIs, as it guides measurement and analyses of policies relevant for long term development, and the assessment of the risks and challenges for its sustainability.

III-3 National Wealth as an Indicator of Sustainability

In the reasoning above I have translated and simplified the question of sustainability to a question of whether we manage our resource base – national wealth – in a way that secures its maintenance over time. Thereby, the focus in the sustainability debate and in the formulation of SD policies has been sharpened since the issue of sustainability has been put in concrete terms, i.e. a question whether our financial-, real-, natural-, environmental- and human capital increase or decline over time. Furthermore, if one wealth component, e.g. petroleum wealth declines, is this being offset by growth of other components such as human capital? This last question touches on whether, and to what extent, the various wealth components can be expected to substitute for each other as far as welfare effects are concerned.

3.1 Critical resources

In our work in Norway it is assumed that it is not so that the various components of national wealth without difficulty and of necessity are replaceable with each other. In other words, it is not so that for instance the services we receive from the environment, which may be considered as dividends of our natural capital, without difficulty can be replaced by increased income, i.e. the dividend of other wealth components such as financial, real or human capital. As an example one may consider a fundamental asset such as a reasonably stable climate. If the climate is destabilised by increased global warming, the basis for our civilisation in the long run may be threatened in a fundamental sense, almost irrespective of our material wealth. The Stern

report: "The Economics of Climate Change" (2006) provides a recent elaboration. Similarly, we know today that biological diversity is a fundamental condition for the maintenance of several central ecosystems' production of services for the benefit of all of us. Without a minimum of biological diversity, the services of central ecosystems may be significantly reduced with, in the event, very adverse consequences for inter alia our food production.

There is in addition an ethical consideration. Certain observers put a question mark on the right of human beings to exploit nature and the environment in a destructive manner, even if this, at least in the short run, may increase total national wealth. I shall not pursue this matter any further here, but only note that the arguments listed above are all important reasons why it is not sufficient to ensure that *total* national wealth is being maintained. It is argued that individual components will also have to be maintained, at least at certain minimum levels, for it to be possible to secure sustainable development. A precautionary approach. It is therefore necessary to monitor the development of key resources and the main individual components of national wealth separately, in addition to assessing the development of total national wealth on a continuing basis.

3.2 System complexity and uncertainty

This point is further strengthened by the fact that we today have limited understanding of how economic activity depends on and influences environment and social relations. The complexity of the climate system, for example, means that it is only with considerable uncertainty that we are able to assess the effects of climate changes. It is a question of assessing future risks and buying insurance against those risks, something we do in our daily life (even if some risks are quite small). Similarly, the multitude of man-made chemicals that escape into our environment is so large that we with our limited present knowledge are unable to predict all their effects, either on nature or on human beings more directly. An important aspect of conservation of biological diversity is the fact that many characteristics and potential values related to diversity still are little known. Nevertheless, as already noted, most of the services of the eco-system that we benefit from depend on the existence of a minimum of biological diversity in these systems. It will therefore be important to maintain ecosystems and biodiversity even if we today are unable to foresee how deficient ecosystem services will affect the economy or our national welfare.

These forms of incomplete knowledge and uncertainty about the future provide an additional reason why key individual elements of the national wealth, measured by a limited or core set of SDIs often measured in physical terms, and not only the total value, are important.

3.3 Practical issues

Even though estimates national wealth is now well known procedure in many national statistical agencies in OECD countries, it is well known that there are practical issues associated with this. In order to add the various components of national wealth, they have to be expressed in a common unit of measurement, usually in the form of money. Ideally, the value of a unit of national wealth should reflect how a unit of the relevant element could contribute to our welfare. However, it is difficult to estimate these so-called shadow prices, especially if the services are not traded in perfectly functioning markets. To repeat, certain individual environmental services provide good examples of services that are not traded in the markets. Thus, estimates of national wealth are usually incomplete. The complex nature of the systems referred to above makes it difficult to find correct prices of all wealth components.

3.4 Summing up

It is at this point that *indicators of sustainability* are useful, if they are selected through a conceptual framework in such a way that they in fact indicate what the expected welfare effects of the key components of national wealth may be. The strategy chosen in Norway as far as the selection of indicators of sustainability is concerned is therefore *to chose indicators that best reflect the value, defined as the welfare effects, of the various components of national wealth*. It is also based on the main policy areas in our National Sustainable Development Strategy and is thus a Policy Oriented Capital Approach.

It is also a practical and durable approach. It is guided, as already stressed, by a sound and well known theoretical framework. It is based on well known and documented statistical methods, and main statistical sources are our national accounts and resource accounts.

IV: THE NORWEGIAN SUSTAINABLE DEVELOPMENT STRATEGY. OVERVIEW

IV-1 Measurement

Since the 1980s, Statistics Norway has as already mentioned worked on natural resource accounting and interlinkages between energy developments, emission of green house gases (GHGs) and economic development.

There is also a long tradition of models of economic growth and longer term developments going back to professor Leif Johansens Multisectoral Growth Model (MSG) in the 1960s. During the 1980s, Statistics Norway developed models so that it could be used for long term projections of interactions between the economy, energy use and GHGs.

This and other models are regularly used by The Ministry of Finance as an aid for long term policy purposes, and the results are presented in White Papers to the Parliament. See: White Paper nr. 8 (2004-2005) "Long Term Perspectives".

As already mentioned, it is clear that GDP, while a key indicator of short term economic and material welfare developments, is not an indicator of whether Norwegian developments are sustainable over the longer term. Present SNA conventions record increases in GDP when petroleum (oil and gas) are extracted. The higher the production, the higher the year to year growth GDP (presently petroleum is some 25 per cent of GDP). But since petroleum is a non-renewable resource, our market based natural capital is drawn down and thus not accessible to future generations of Norwegians. Clearly, for longer term considerations of sustainability of present developments, a balance sheet approach is needed. One has to ask whether other types of capital is being built up as our stock of natural capital is drawn down.

Natural Wealth is a useful starting point for such considerations, and it is computed at fairly regular intervals.

In White Paper No. 8 (2004/2005) "Challenges and Choices for the Norwegian Economy" presented to the Parliament in the Fall of 2004, the former government put forth calculations of developments in the main components of Norwegian NW, op.cit, Diagram 5.9 page 99. These show that NW per capita has increased considerably from 1970 to 2003. Furthermore, it is shown that our natural capital seems less important for future developments in 2003 compared to 1970, while the importance of human capital had increased significantly.

The point of departure for The Norwegian Sustainable Development Indicator Commission was the key capital components driving development and the main policy areas in The Norwegian Sustainable Development Strategy.

In the column to the left in table 1, the 18 core national indicators derived from the policy oriented capital framework for sustainable development are listed. In the heading of the table, the 18 indicators are referred to the main policy areas in our SD Strategy. Finally the set is related, in the table to the right, to the five types of national capital:

- Financial capital
- Real capital
- Human capital
- Natural capital
- Environmental capital

As explained above, a constant or increasing NW per capita is seen as a necessary but not sufficient condition for sustainable development. I.e. it is not assumed that we are necessarily on a sustainable path if NW per capita remains constant. (In fact it increased considerably from some 5 million Norwegian kroner (NOK) per capita in 1985 to between 6 and 7 million NOK per capita in 2001).

A main reason is that complete substitutability between different types of capital is not assumed⁴. In addition as underlined above, one needs indicators – often measured in physical terms – of the other types of capital. Notably, one is looking for critical levels of e.g. biological diversity beyond which one risks irreversible developments not only to the environment, but to future economic developments as well. Each of the 18 indicators in the present national SD core indicator set is examined in this regard.⁵

This is discussed in more detail in Appendix 2. Thus the process starts by evaluating overall real NW estimates pr capita and their developments over time. Then one looks in more detail at largely physical indicators in the core Norwegian SDI set. Possible problems or challenges in some policy areas are then analysed in more detail, see section IV-2.

⁴ I.e., strong sustainability is assumed.

⁵ Table 1 refers to SDIs published by Statistics Norway in: Natural Resources and the Environment. 2006.

Table 1: Norwegian SD core indicator set and relations to main policy areas and components of the national wealth

	Indicators	Policy areas that the indicators shall cover	Issues						Components of the national wealth				
			Climate, ozone and long-range-transported air pollution	Bio-diversity and cultural heritage	Natural resources	Hazardous substances	Sustainable economic development	Social areas	Financial assets	Fixed assets	Human capital	Natural resource capital	Environmental capital
1	Norwegian ODA as percentage of gross national income (GNI)	Global poverty reduction					✓	✓					
2	Trade with Africa, by LDC-countries and other African countries	Global poverty reduction					✓	✓					
3	Emissions of greenhouse gases compared with the Kyoto Protocol target	Climate change	✓										✓
4	Percentage of land area where the critical load for acidification has been exceeded	Acidification	✓	✓	✓							✓	✓
5	Population trends of nesting wild birds	Terrestrial ecosystems		✓	✓							✓	✓
6	Percentage of rivers and lakes with clearly good ecological status	Fresh water ecosystems		✓	✓							✓	✓
7	Percentage of localities (coastal waters) with clearly good ecological status	Coastal ecosystems		✓	✓							✓	✓
8	Standards of maintenance of protected buildings	Cultural heritage		✓						✓			
9	Energy use per unit GDP	Efficiency of resource use			✓		✓			✓		✓	✓
10	Recommended quota, TAC actually set and catches of Northeast Arctic cod.	Management of renewable resources			✓		✓					✓	
11	Irreversible losses in biologically productive areas	Productive areas		✓	✓							✓	✓
12	Household consumption of hazardous substances	Hazardous substances					✓				✓		✓
13	Net national income per capita, by sources of income	Sources of income			✓		✓		✓	✓	✓	✓	✓
14	Petroleum adjusted savings	Sustainable consumption					✓	✓	✓	✓			
15	Generational accounts: Need for tightening of public finances as share of GDP	Sustainable public finances					✓		✓				
16	Population by highest level of education completed	Level of education					✓	✓			✓		
17	Long-term unemployed persons and disability pensioners as percentage of population	Exclusion from the labour market					✓	✓			✓		
18	Life expectancy at birth	Health and welfare					✓	✓			✓		

IV-2 Policies

For policy makers the notion of longer term development can be seen as a process of portfolio management. Certain assets in the portfolio are exhaustible and can only be transformed into other assets through investment of the resource rents. Other assets are renewable and can yield sustainable income streams. Saving – the creation of a surplus for investment – is a core aspect of longer term development.

Main policy areas in the Norwegian SD Strategy are:

- International Cooperation for Sustainable Development and the Fight against Poverty
- The Climate, The Ozone Layer and Long Transports of Air Pollution
- Biological Diversity and Cultural Heritage
- Natural Resources
- Hazardous Chemicals
- Sustainable Economic and Social Developments

For more details, see The National Budget 2007, chapter 7.

Key policy considerations are:

- To maintain and enhance National Wealth per capital broadly defined
- Ensure that our environmental and natural capital is not reduced beyond critical or irreversible levels
- Seek development that is economically and socially sustainable

As mentioned above, GDP increases as petroleum – a non-renewable resource – is extracted. A key concern is therefore sustainable management of our natural resources, and to build up other types of capital.

Present policy in Norway is to put all revenues from exports of petroleum into a Petroleum Fund, now called The Pension Fund-Global, and invest the money exclusively in foreign bonds and stocks. Thus as our non-renewable natural capital is drawn down, our stock of financial capital abroad is built up for the benefit of future generations. Only 4 per cent of the stock of The Pension Fund-Global, the yearly estimated rate of return, is used for domestic purposes. This is similar to the Hartwick rule for managing natural resources sustainably, see Hartwick, op.cit.. The capital stock itself belongs to future generations of Norwegians, a key policy rule for SD.

Norway has ratified the Kyoto Protocol. In order to reach our Kyoto targets we use, inter alia, market oriented instruments such as:

- CO₂ taxes, introduced in 1991, to put a price on green house gas emissions.
- A trading scheme, as part of the European Economic Area (EEA) agreement with the EU, for buying and selling emission quotas. This scheme will be operating in 2007 under the responsibility of The Ministry of Finance.

Market oriented policy instruments are given considerable emphasis in longer term development policies because they are cost-efficient, they leave decision making to

decentralised households and firms, and they are dynamic in the sense that they stimulate technological innovations.

Economic models are used to simulate, on present policies (BAU) and projected exogenous developments, what emissions may be in the Kyoto period (2008-2012) and in the longer term. The CO₂ taxes, the trading system and other measures are set so as to reach the Norwegian Kyoto targets. This illustrates how policy measures, the SD indicator green house gas emissions (GHGS), and simulations into the future with economic models, are used in the policy making process. The most recent GHG projections for Norway were presented in The National Budget for 2007. These show that additional measures are needed in order to reach the national Kyoto target.

It is assumed that sustainable public finances is an important condition for SD. Using generational accounting methods computed at regular intervals indicate, despite our petroleum revenues, that our public finances may not be sustainable in the long term (2050). As an alternative to raising taxes in the future, pension reform and curbing the growth in public expenditures are presently considered in order to achieve long term balance in public finances. For a further discussion of the generational accounts see White Paper No. 8 (2004/2005) op.cit, Box 5.2 and Table 5.4, pages 94 and 95.

Similar considerations and analyses are carried out for other policy areas if the core SDI set indicate challenges to sustainability, see appendix 2.

IV-3 Governance

The Norwegian government presented a National Sustainable Development Strategy (NSDS) to the Johannesburg Summit in 2002. To transform the strategy into a more concrete and policy oriented guide for policies, it was decided to develop a Norwegian Action Plan for Sustainable Development, National Agenda 21 (NA 21).

NA21 was presented by the Norwegian government to the Parliament in its main economic policy document – The National Budget – in the fall of 2003.

The coordination of the follow up is the political responsibility of the Minister of Finance. To aid the minister in this task, a group of State Secretaries has been established chaired by The Ministry of Finance.

The follow up of concrete policies to enhance sustainable development in Norway is reported in the yearly National Budgets.

The new Norwegian government has decided to follow the same conceptual, measurement and governance procedures and will present a revised National Strategy for Sustainable Development in the Fall of 2007.

The Norwegian Ministry of Finance has a long tradition of long term planning, and of carrying out long term analyses – often with the aid of models largely developed by Statistics Norway. Some examples of the use of these aids for policy purposes were given in section IV-2 above.

Furthermore, The Ministry of Finance in Norway coordinates economic policies, tax policies, budget policies and financial market policies, and it participates actively in structural- and sectoral policy making. Since SD is seen as a core, overall long term policy framework in which coordination and integration of economic, environmental and social policies are important, this option has been chosen.⁶ Of course, it remains to be seen how successful this governance structure will be as it has only been in existence for approximately four years. The main objective is to put SD squarely in the centre of policy making.

Statistics Norway coordinates work on SD statistics and indicators. This agency is independent in the sense that it is governed by a separate law and board. It also maintains and develops the main analytical models used by The Ministry of Finance.

V SOME SUGGESTIONS FOR FURTHER WORK

Obviously, there is considerable scope for more work and further improvements . Let me in closing mention some possibilities.

Present NW methods start with a top down approach, and one decomposes and end up with a large residual which is largely human capital.⁷ In Norway human capital is by far the largest component of NW, two-thirds to three fourths. Enhancing human capital is key to future economic and social development. The SD indicator used presently is: "Population by highest level of education completed", indicator 16 in Table 1 above. Greaker (2006) has in a recent note from Statistics Norway made proposals as to how to improve measurement of human capital in order to arrive at more direct measurements.

As already mentioned, a national SD strategy should not only focus on national sustainability, but also on a country's contribution to global sustainability. Thus, as The Norwegian Indicator Commission proposed, the following four indicators of such possible contributions: GHGs, energy use, foreign aid and trade with Africa/MVL countries are included. See table 1 and appendix 2. This is consistent with a natural resource/national wealth framework. Norway has ratified the Kyoto protocol and is committed to contribute to long term global solutions, even if it may – viewed in isolation - result in slightly lower levels of national wealth per capita. The same applies to foreign aid. One could argue that if global solutions can be found in these areas, future generations would be better off even if Norwegian wealth per capita – which will be very high by international comparisons anyway – will be somewhat lower. In any case, the Norwegian government is politically committed to contribute – economically and otherwise – to global sustainability. In this connection, we should continually look for good national indicators for a country's contribution to global SD, even if it should be acknowledged that there are limits to what a small country can do directly.

In a Swedish Peer Review of Norwegian policies for sustainable development (2007) it is suggested that the present indicators for trade and foreign aid should be reviewed, complemented and changed in certain cases. E.g. an indicator for the quality of foreign aid, not only volume, is proposed. And the MUL countries' exports to Norway as a share of these countries' total exports should replace the present one.

⁶ Chancellor Gordon Brown in the UK recently proposed that EU and EFTA Ministries of Finance should engage actively and cooperate in climate policies.

⁷ See Greaker (2006) and appendix 1 for more details.

Indicators 5, 6 and 7 should show the state of important elements of our natural capital:

- Terrestrial ecosystems,
- Fresh water ecosystems, and
- Coastal ecosystems.

Ideally, these indicators should be able to tell us e.g. how close we may be in Norway to critical levels of key aspects of our natural capital, or to what extent there are sustainability threats to our ecosystems. Also in these areas are there room for further work and improvements.

The above mentioned Swedish Peer Review have useful suggestions also in this area, for example to emulate EU's Natura 2000 System to a larger extent than today.

These views will be carefully considered during the ongoing revision of The Norwegian National Sustainable Development Strategy.

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Appendix 1 Computation of National Wealth

Recent descriptions of present methods for computing national wealth (NW) have been given in The Norwegian Indicator Commissions book: "Simple Signals in a Complex World: Proposal for a National Set of Indicators for Sustainable Development", NOU 2005.5, appendix 2, and by Mads Greker: "National Wealth and the Computation of Human Capital", Statistics Norway 2006. Since these are both in Norwegian, a brief English summary is given below.

Below is a brief English summary, based on Greker op.cit, how Statistics Norway estimates NW and its main components.

The value of each category of capital is defined as the present value of the income or services that these can be expected to yield in the future. Briefly, the following three steps are followed:

Step 1. Natural resources are particular goods because they are not produced by inputs of labour and produced capital. Exploitation of NC will therefore provide added value to the extent they are managed efficiently. This added value, or resource rent RR, is the income from NC left after the expenditures of extraction and sale are deducted. RR for each category of NC is thus computed based on the national accounts (SNA). For the period 1985 to 2004 this was done for the following categories in Norway: fisheries, forests, agriculture, hydro power, oil and gas and mining.

Step 2: Net National Income (NNI) is decomposed each year based on the national accounts and the definition of GDP as follows: $NNI =$

- i) RR for renewable NC (fish, forests, agriculture, hydro power);
- plus ii) RR for non-renewable resources (oil, gas and mining);
- plus iii) The return on the stock of produced capital, PC;
- plus iv) Net income from wealth and wages to abroad;
- plus v) The return on human capital, HC.

iv) comes directly from SNA, and HC is arrived at as a residual.

Step 3: Computation of NW =

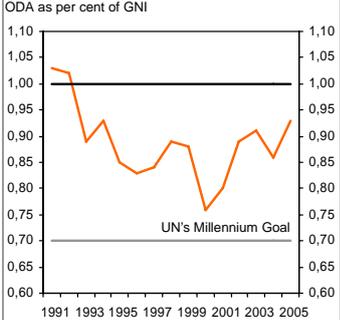
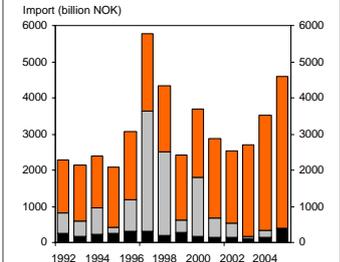
- i) Present value of RR of renewable NC;
- plus ii) Present value of RR of non-renewable NC;
- plus iii) Present value of the rate of return of HC;
- plus iv) The stock of produced capital, PC;
- plus v) The stock of net claims on foreigners.

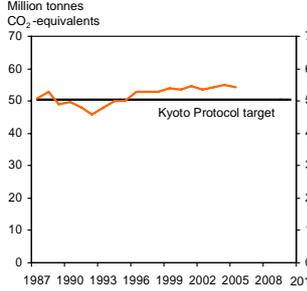
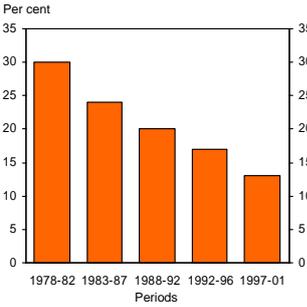
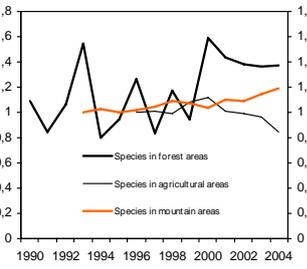
NW in Norway grew in real terms from some 2000 billion NOK in 1985 to some 3000 billion NOK in 2004. Shares in 2004 were: NC 12 pst, PC 12 pst and HC 76 pst (NW of agriculture was found to be negative).

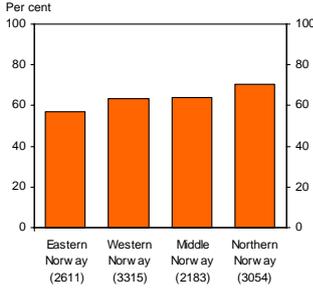
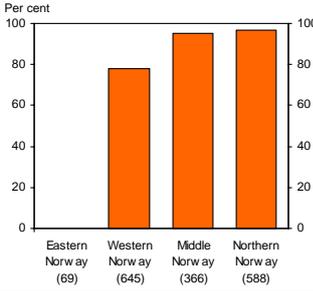
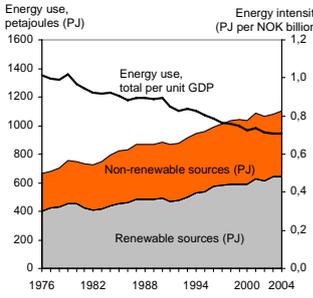
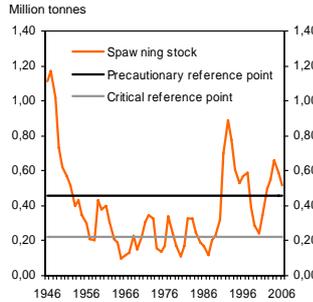
Reference is also made to Asheim: "Indicators of Welfare Improvement and Sustainability", appendix 3 in NOU 2005:5.

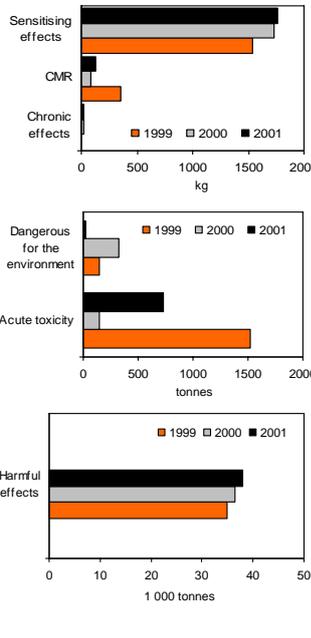
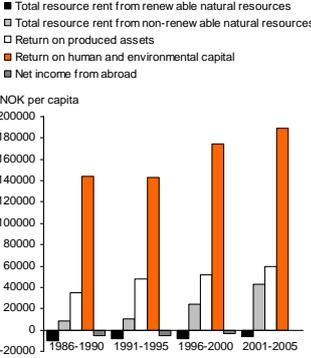
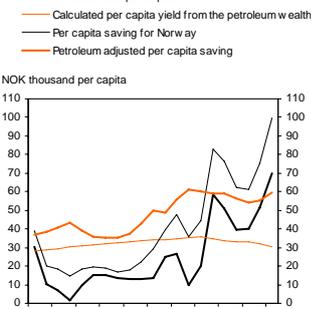
Appendix 2. A presentation of the core set of indicators for Sustainable Development in Norway

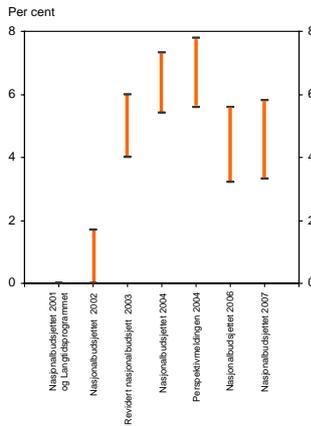
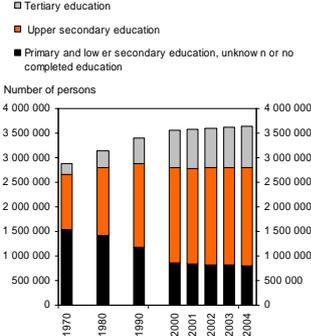
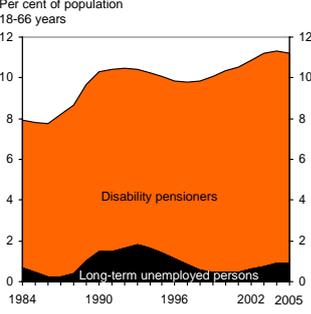
A general overview of the indicator set is presented below, together with figures and brief descriptions.

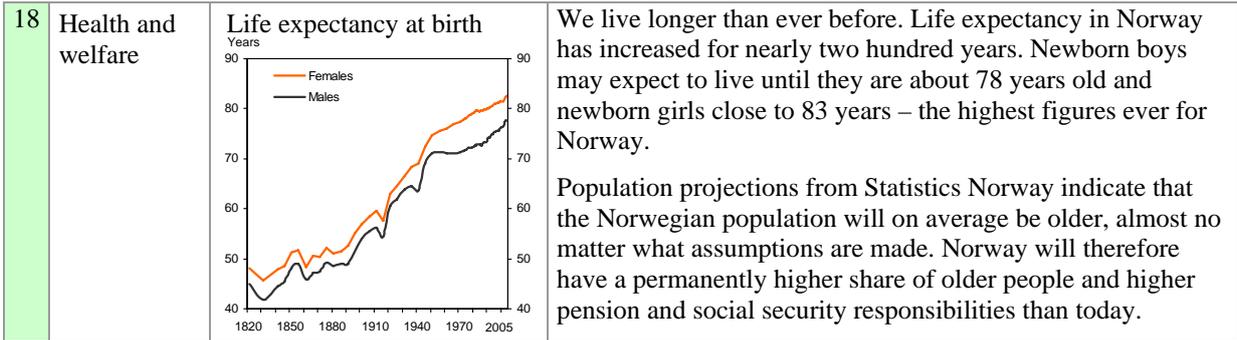
	Issues	Indicators	Short description of the indicators
1	Global poverty reduction	<p>Norwegian development assistance as percentage of gross national income</p> 	<p>The effect of development assistance on poverty reduction and economic development is a much discussed topic. However, the predominant viewpoint seems to be that development assistance is effective, but only under certain conditions. Assistance seems to have a poverty reducing effect in countries with a stable economic policy, well-established institutions, little corruption and a high level of poverty.</p> <p>Internationally, according to UN's Millennium Goals, the donor countries should contribute 0.7 per cent of gross national income (GNI) to official development assistance (ODA).</p> <p>The Norwegian government's goal is 1 per cent, while opting for a further increase when that goal is reached. In 2005, Norway gave 0.94 per cent of gross national income as official development assistance.</p>
2	Global poverty reduction	<p>Trade with Africa, by LDC-countries and other African countries</p> 	<p>In the UN's Millennium Goals, adopted in year 2000, the most important target is the reduction of global poverty. According to calculations by the World Bank, economic growth is shown to be vital for poverty reduction. To give the developing countries the possibility to sell their goods and services to industrialized countries on the same terms as other countries is an important measure that may contribute to economic development in these countries. Economic and technical assistance, better education, good governance and improved health conditions are also important.</p> <p>Imports from Africa constitute only a small percentage of total import to Norway. The import from Africa accounts for approximately 1 per cent of total Norwegian import, with a value of NOK 4.6 billion in 2005. In 2005, imports from the least developed countries (LDCs) in Africa constituted just below 0.1 per cent of total import, increasing from a low point in 2003. The Norwegian trade with African LDCs has been dominated by imports of used ships from Liberia and must be seen in connection with Norwegian ship owners' use of the international ship register there. If we disregard this, the imports from the other 32 LDCs in Africa have been very modest and rather stable in the whole period.</p>

3	Climate change	<p>Norwegian emissions of greenhouse gases compared with the Kyoto target</p>  <p>Million tonnes CO₂-equivalents</p>	<p>The report <i>"Impacts of a Warming Arctic"</i> (ACIA, 2004) points out that the temperature increase in the latest decades has been nearly twice as fast in the Arctic areas as in other areas of the world. The climate change may have considerable effects on the environment, resources, society and economy. Not all the effects will be negative, but changes can nevertheless represent big challenges for society.</p> <p>Greenhouse gas emissions in Norway fell by 1 per cent from 2004 to 2005. The fall in 2005 emissions can be explained by a reduction in use of oil for heating, due to high oil prices. There has also been reduction in emissions from parts of the emission-intensive manufacturing industries.</p> <p>The overall rise between 1990, the base year for the Kyoto Protocol, and 2005 is 9 per cent. Road traffic and oil and gas production are the most important sources of growth in CO₂ emissions from 1990 to 2004. Road traffic emissions increased also in 2005, together with emissions from domestic shipping and domestic air transport.</p>
4	Acidification	<p>Percentage of Norway's land area where the critical load for acidification has been exceeded</p>  <p>Per cent</p>	<p>Acidification is still an important environmental problem in Norway, even though reduced emissions have improved the conditions somewhat. The greatest improvements have occurred in Eastern Norway, with positive development observed in Southern Norway and the southern parts of Western Norway as well. Sør-Varanger municipality in Finnmark suffers the effects of acid rain from sources in northern Russia.</p> <p>At the beginning of the 1980s the critical loads were exceeded across 30 per cent of the total area of Norway. European emissions of acidifying gases have been reduced and consequently the pressure on Norwegian nature has been reduced. Around year 2000, the critical loads were exceeded across 13 per cent of the total area. With the reductions in emissions expected by 2010, it has been calculated that critical loads will still be exceeded in an area corresponding to 7-8 per cent of the total area of Norway. Fish mortality and damage to fish stocks will therefore continue unless preventive measures such as liming are also kept up.</p>
5	Terrestrial ecosystems	<p>Bird index – Population trends of nesting wild birds</p>  <p>Stock size index</p>	<p>The trends of different bird stocks are considered to give a good indication of the state of their habitats. In mountain areas, there has been an increase in the stock of nesting birds. This is an expected trend caused by warmer climate and a denser mountain forest. The figures for forest birds show large variations from year to year and no clear trend. This may be caused by real variations of stocks, but may also be a result of the data collection method. In agricultural areas the stock trends are also uncertain. The three data series shown are all based on incomplete data and are not representative for the country as a whole.</p> <p>The data used for this indicator needs further development.</p>

6	Fresh water ecosystems	<p>Rivers and lakes with clearly good ecological status</p> 	<p>The indicators for aquatic ecosystems are clearly policy relevant, as they are connected to the EU water framework directive. According to this directive ecological status of inland and coastal water localities shall be classified into five categories: high, good, moderate, poor and bad. Each member country must develop classification methods and monitoring systems.</p> <p>Most inland and coastal waters in Norway have a good ecological status. This is especially the case in the more sparsely populated areas (Western, Middle and Northern Norway). The conditions seem to be somewhat worse in Eastern Norway, especially in coastal waters. Here, none of the assessed localities have been categorised as clearly good.</p>
7	Coastal ecosystems	<p>Localities in costal waters with clearly good ecological status</p> 	<p>The figures are preliminary and a number of localities with uncertain ecological status will probably be classified as good after a closer assessment, also localities in coastal waters in Eastern Norway.</p>
8	Cultural heritage	Standards of maintenance of protected buildings	<p>This indicator is in progress. The protected buildings will be assessed into four categories according to the need for improvements.</p>
9	Efficiency of resource use	<p>Energy use per unit GDP</p> 	<p>In modern economies, energy is an essential input factor, and energy production and use have consequences irrespective of energy source such as air emissions, water pollution, waste problems and impacts on landscape and biodiversity.</p> <p>Except for a couple of years, the Norwegian economy has had a stronger growth in GDP than in domestic energy use, although energy use has also increased substantially. From 1976 to 2004 the energy use increased by 67 per cent. However, the GDP growth in the same period was 139 per cent. The energy intensity, measured as energy use per unit GDP, has therefore decreased in the period, implying a more efficient energy use.</p>
10	Management of renewable resources	<p>The size of the spawning stock of Northeast Arctic cod, relative to the precautionary reference point</p> 	<p>Fishing has been an important basis for settlement and economy during all of Norway's history. Sustainable management of fish resources implies that they should not be exploited to such a degree that there is a high probability of poor recruitment. Without sufficient recruitment, the basis for a long-term and sustainable exploitation of this resource is destroyed.</p> <p>The stock of Northeast Arctic cod is jointly managed by Norway and Russia. Looking at the period 1978-2003, the accumulated catches have been about 600 000 tonnes above the total allowable catch.</p> <p>As for 2006, the size of the spawning stock is above the precautionary reference point signalled by ICES (International Council for the Exploration of the Sea).</p>

11	Productive areas	Irreversible losses in biologically productive areas	Biologically productive areas are a critical resource, but data for an indicator is not available yet.
12	Hazardous substances	<p>Household consumption of hazardous substances</p>  <p>The first chart shows Sensitising effects in kg: 1999 (~1500), 2000 (~1600), 2001 (~1700). The second chart shows Dangerous for the environment in tonnes: 1999 (~100), 2000 (~150), 2001 (~200). The third chart shows Harmful effects in 1 000 tonnes: 1999 (~35), 2000 (~38), 2001 (~40).</p>	<p>In recent years there has been an increased awareness of the relations between exposure to hazardous substances and health effects in humans. Such substances also have adverse and long-lasting effects on the environment.</p> <p>The use of cancer-causing, genetically harmful agents or agents harmful to human reproduction was reduced by more than 60 per cent from 1999 to 2001. The reason for the decrease was that the industry used less of such products after a fee was imposed on perchloroethylene that is used for cleaning products.</p> <p>The use of allergy-causing (sensitising) agents increased by 200 tonnes or 14 per cent from 1999 to 2001. The main reason for this is increased use of paint and varnish products, plus cleaning products classified as allergy causing. The largest quantities of hazardous substances that the households are exposed to are included in the category "Harmful". This group includes products that may cause damage because they contain solvents, substances with corrosive or irritating effects, etc. The consumption of such products in 2001 was 38 000 tonnes, an increase of 9 per cent in the three-year period from 1999.</p> <p>The data used for this indicator needs further development.</p>
13	Sources of income	<p>Net national income per capita, by sources of income</p>  <p>Legend: Total resource rent from renewable natural resources (black), Total resource rent from non-renewable natural resources (white), Return on produced assets (grey), Return on human and environmental capital (orange), Net income from abroad (dark grey).</p> <p>The chart shows that Return on human and environmental capital (orange) is the largest component, increasing from ~140,000 NOK in 1986-1990 to ~180,000 NOK in 2001-2005. Return on produced assets (grey) also shows a significant increase over the period.</p>	<p>The net national income (NNI) may be considered the market-based yield of our national wealth. Variations in NNI over time may therefore be considered an indication of changes in the wealth.</p> <p>The indicator shows that human capital and environmental capital are of utmost importance for our economic welfare. The importance of the exploitation of non-renewable resources, mainly oil and gas, has increased strongly since 1985, and is now close the yield from produced assets. The resource rent from the primary industries, agriculture, forestry and fisheries, has been negative, mainly due to subsidies to agriculture. However, the size of the deficit has decreased in the period considered.</p>
14	Sustainable consumption	<p>Petroleum adjusted savings</p>  <p>Legend: Petroleum rent per capita (black), Calculated per capita yield from the petroleum wealth (orange), Per capita saving for Norway (grey), Petroleum adjusted per capita saving (red).</p> <p>The chart shows that the petroleum adjusted per capita saving (red) is consistently positive, fluctuating between 30 and 60 thousand NOK per capita. The calculated per capita yield from the petroleum wealth (orange) is also positive, generally between 40 and 70 thousand NOK per capita.</p>	<p>Are we consuming too much? Or to be more precise: has the Norwegian population consumed more during one year than we have reason to believe can be sustained over time? If the answer is yes, the consumption may not be characterised as sustainable. The indicator "Petroleum adjusted savings" is meant to illustrate this issue, even though several important aspects of consumption are not included.</p> <p>The petroleum adjusted savings has been positive in the whole period considered, even when the return of the petroleum wealth is not included in the calculations. The level of consumption in Norway may therefore be characterised as sustainable, at least seen from a national perspective.</p>

15	Sustainable public finances	<p>Generational accounts: Need for tightening of public finances as share of GDP</p>  <p>Per cent</p> <p>8 6 4 2 0</p> <p>Næringsbudsjettet 2001 og Lørdagsprogrammet Næringsbudsjettet 2002 Revidert næringsbudsjettet 2003 Næringsbudsjettet 2004 Periodevisvirkningen 2004 Næringsbudsjettet 2006 Næringsbudsjettet 2007</p>	<p>The public sector plays an important role for the total welfare, by using policy to influence the economic activity in the private sector, producing basic services within education, providing health and social care, etc., and by maintaining a comprehensive social security system. The expenses for these systems must, over time, be financed within the limits of the total public income and the initial wealth.</p> <p>The generational account is a calculation of whether today's financial policy is sustainable in the long-term. If this is to be the case, public sector expenses must, over time, balance public sector income. The calculated need for tightening of public finances, as estimated in the generational accounts, did increase over time, partly as a result of altered assumptions concerning the development of life expectancy. Higher income from the petroleum sector has decreased the need for tightening of public finances, and the latest estimates are in the range of NOK 50-90 billion. This is between 3¼ and 5¾ per cent of GDP for 2006.</p>
16	Level of education	<p>Population by highest level of education completed</p>  <p>□ Tertiary education ■ Upper secondary education ■ Primary and lower secondary education, unknown or no completed education</p> <p>Number of persons</p> <p>4 000 000 3 500 000 3 000 000 2 500 000 2 000 000 1 500 000 1 000 000 500 000 0</p> <p>1970 1980 1990 2000 2001 2002 2003 2004</p>	<p>Human capital is a component of national wealth with significant contribution to economic growth. The population's level of education may be considered as an indicator of the supply of qualified labour for the public and private sectors.</p> <p>The level of education of the Norwegian population has increased considerably over the last 30 years. In 1970 about 7 per cent of the population had an education at the university level (tertiary education). In 2004, this number had increased to 24 per cent - an increase of 17 percentage points during the last 34 years. The last 20 years of the period (1983-2003) the number of people with a PhD-degree has increased by 286 per cent (from 3 550 to 13 750 persons). In the other end of the scale, the share of people with only primary and lower secondary education has decreased by over 30 percentage points since 1970.</p>
17	Exclusion from the labour market	<p>Long-term unemployed persons and disability pensioners</p>  <p>Per cent of population 18-66 years</p> <p>12 10 8 6 4 2 0</p> <p>Disability pensioners Long-term unemployed persons</p> <p>1984 1990 1996 2002 2005</p>	<p>For most people, employment is an important part of social life and important for a feeling of well-being and the feeling of being included and appreciated. This is true although in Norway there are rather well established social security arrangements for those that for different reasons are excluded from the labour market.</p> <p>In the economic recession at the beginning of the 1990s a rather high percentage were excluded from the labour market. This applied to both long-term unemployed persons and disability pensioners. After a passing decrease, the percentage has increased again to 11 per cent of the population in 2005. In 2005, the total of long-term unemployed persons was 27 000 persons while disability pensioners accounted for over 300 000 persons</p>



Appendix 3. Some other attempts at measuring the sustainability of a given development

Internationally, one can find different traditions and approaches as far as attempts at measuring the extent to which a given development is sustainable is concerned. For the sake of simplicity we distinguish between three groups, see e.g. Giovannini, 2004.

Sets of individual ad hoc indicators without a theoretical framework have been developed, cf. various national sets of indicators, the UN's Commission for Sustainable Development (2001), and the work of Eurostat. A good summary of these and similar sets can be found in Hass et al. (2002).

Other initiatives have aimed at supplementing and expanding traditional national accounts with information on resource use and environmental conditions. Thus, the UN has published standards for the compilation of so-called satellite accounts; SEEA (United Nations et al. 2003). In this tradition, the Netherlands at an early stage developed methods for grouping together economic- and environment-related variables in its so-called NAMEA-system. Work aimed at expanding and supplementing traditional national accounts have long traditions in Norway through the development of national resource and environmental accounts from the end of the 1970s, see inter alia Alfsen et al. (1987) for a survey and evaluation.⁸

Moreover, a number of individual studies and very aggregate indicators designed to provide simple measures of sustainability have been developed (a survey is provided in World Bank, 2003). In this tradition the World Bank has developed and published an indicator called "genuine savings", where a country's net national product, the value created after subtraction of the maintenance of the capital stock, is adjusted for the use of non-renewable resources and depreciation of the environment. See Hamilton (2000) and the more recent World Bank publication (2005).

"The Genuine Progress Indicator" (Redefining Progress, 1999, 2001) and "Index of sustainable economic welfare" (Daly and Cobb 1989, Cobb and Cobb 1994), are other indicators that in various ways adjust net national product for loss of welfare related to environmental and social conditions.

"Environmental pressure index" (Jesinghaus, 1999), "Environmental sustainability index" (World Economic Forum 2002) and "Well-being of nations" (Prescott-Allen 2001) are other approaches where a number of factors related to the environment and social conditions have been measured by separate indicators, and where an overall index is calculated using weights and by aggregating the various indicators. I argue that these are not indicators of sustainable development, but useful for guiding more detailed (often shorter term) environmental and social policies.

Among mainly biophysically based indicators we find "Ecological footprint", published by the World Nature Fund (WWF) (Rees and Wackernagel 1994, WWF 2004), which measures

⁸ One important question is to what extent core SDI sets of sustainable development should increasingly be based on satellite accounts such as SEEA as these are developed further in CES countries under the auspices of the UN, and other non-market accounts as suggested in: Beyond the Market. Designing Non Market Accounts for the United States (2005).

the amount of productive land needed to supply the world with food and fibre, as well as energy in renewable form. "Living planet index", tries to summarise the development of biodiversity in terrestrial, marine and fresh water based ecosystems (WWF 2004). Such indicators may be useful to highlight important environmental aspects of sustainable development, but ignores (the interaction between) the economic and social components of sustainable development.

Finally, I draw attention to environmental efficiency indicators seeking to indicate a society's overall consumption of materials (Bringezu and Schütz 2001a,b, Eurostat 2001, 2002). These may be useful for environment policies but say little about sustainable development.

I argue that rather large numbers of indicators, often representing measurements without theory, have been developed which only to a limited extent have been able to focus on issues of critical importance for the long term sustainability of developments. Instead, attempts have been made to measure almost all aspects of developments. On the other hand, the construction of single aggregate indicators has often made it difficult to judge how individual areas of importance for sustainability have been weighted and aggregated. This uncertainty tends to reduce confidence and usefulness in such aggregate indicators, and it often leads to discussion of methodology rather than substance. To me, the challenge consists of striking a balance between these various considerations, while having a clear conceptual or theoretical base and maintaining a sharp focus on matters that are or may be of great political and practical importance for policies to enhance the sustainability of future long term developments.

The World Bank, based on a capital framework, now publishes estimates of wealth and its components for nearly 120 countries regularly. See: "Where is the Wealth of Nations. Measuring Capital for the 21st Century" (2005). This is a simple and analytically sound basis for further international work on measuring sustainable development. As argued in the main paper, estimates of genuine savings should be supplemented in national SDI sets – where appropriate – by more detailed indicators in key policy areas where the sustainability of longer term developments may be at risk.