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SUSTAINABILITY INDICATORS – THE NORWEGIAN EXAMPLE

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I. INTRODUCTION

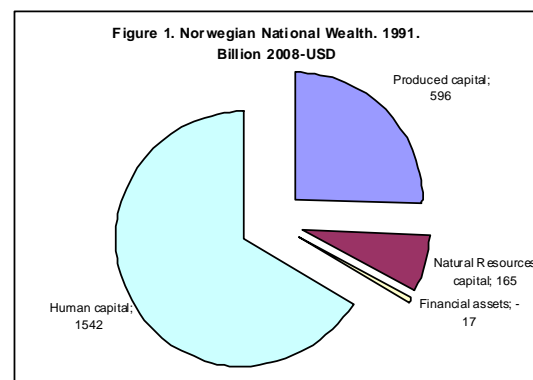
1. In this paper we present the development of the Norwegian sustainable indicator approach, from calculating national wealth, to presenting a total indicator set based on political issues and the capital approach, and finally a set up of a “consistent capital” approach indicator set.
2. The concept of sustainability was first introduced in the public debate by the report “Our common future” by the World commission on Environment and Development (WCED, 1987). The commission stressed that “sustainable development is development that meets the need of the present without compromising the ability of future generations to meet their own needs”, i.e. distribution *among our own generation* and *across generations* are focused. Compared to the plain capital approach this may be considered an extension when including *among countries*.
3. The aim of this perspective is to focus on global wealth. However, in practice the focus is on national wealth and each country’s contribution to the development of global wealth. One important aspect then is to include indicators illustrating the influence on the distribution of wealth among countries, either directly (by financial support) or indirectly (environmental improving efforts). This may be categorized as part of social capital, resource capital (or other capital forms if applicable) or as an additional measure to the other original capital forms. Our indicator set then includes indicators for development aid.
4. In economic literature, and in the United Nations: Measuring sustainable Development (WGSSD 2009), sustainable development is defined as *a development that ensures non-declining per capita national wealth by replacing or conserving the sources of that wealth*. This includes stocks of produced, social and natural capital, i.e. we should consider changes in both different kinds of capital stock, and population growth. Wellbeing is provided from all goods and services produced from all kinds of capital stocks, and what matters are that everybody’s wellbeing is considered (i.e. population growth is important). Our approach includes both stock and flow indicators.
5. Although the capital approach as a measure of total wealth seem ideal in theory, aggregation over the portfolio of capitals in practise is impossible, since appropriate prices do not exist – and even shadow prices are difficult to calculate. Some of the capital elements in

total wealth may be calculated, while other elements are simple illustrations of important features within categories of capital. An important question is to what degree decrease in one indicator is offset by growth in another indicator, and the overall effect on total welfare. In practice such deliberations are continuously made by politicians. In theory, we then may calculate the implicit minimum shadow prices. However, deliberations mostly include a set of trade-offs, which increase the complexity. The complexity increases even more by introducing critical resources (shadow prices increase to infinity). Critical resources, i.e. minimum values of critical components (say biodiversity cf. uncertainty about the future, hazardous compounds etc) of total wealth must be handled separately. Our indicators include both indicators in value and physical measures.

II. THE NORWEGIAN NATIONAL WEALTH

6. Since 1993 Statistics Norway has published figures for what we have called *national wealth* (Statistics Norway 1993), see figure 1.

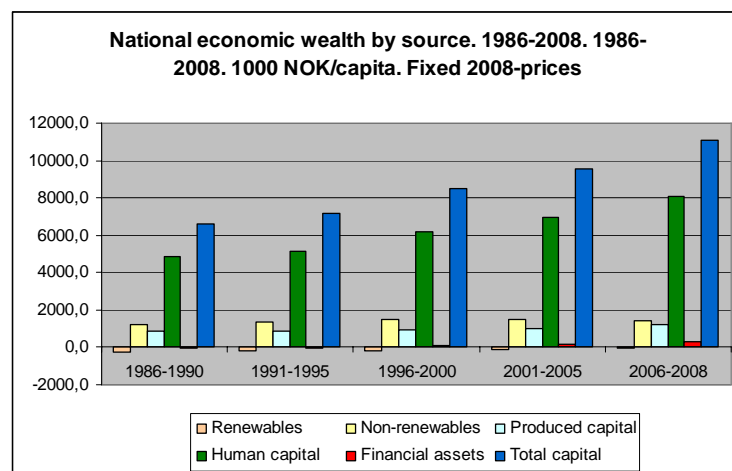
This includes financial assets, produced capital, natural resources capital (oil, gas, hydro, fish and timber), and human capital. Total wealth in 1991 was estimated to 1 542 billion USD (2008-prices). *Human capital* forms the largest share, 67 percent, *Produced capital* 26 percent, *Natural resources* 7 percent while *Financial assets* contributed negatively (net debt). These figures do not include all natural resources, nor environmental and social capital figures or indicators.



The Natural resources capital is calculated as net present value of future net income from the resource, and is based on production profiles and guesstimates of future prices. *Produced capital* and *Financial assets* are from the National accounts. *Human capital* is calculated as a residual; the net present value of net national product subtracted the other components mentioned above. These figures are calculated annually, however, lately on a per capita basis, see below.

7. Greaker, Løkkevik and Walle (2005) presented calculations of national wealth back to 1985. In Brunvoll et al (2009), these figures are updated to 2008.

8. Total economic wealth has increased over time, see figure. (68 per cent),. *Human capital* is the largest share (73-74 percent). Compared to what most people seem to think, non-renewables is less important for



Norway (decreased from 18 to 13 percent from 1986-2008. *Financial capital* constitutes only 3 per cent (although it amounts to more than one year GDP in Norway).

9. An interesting aspect is the development of the *Renewables resource* capital. In the late 1980s this was negative. This is due to the way we calculate the figures. In the power sector, which is mainly hydro power, there is a ground rent, i.e. a net positive wealth value. But since this sector have been regulated both with respect to prices (e.g. price caps and low prices to power intensive industries), and with respect to the development of new capacity, the calculated resource rent is negative. This does not mean that there is no ground rent, but the ground rent has been distributed through the power market. The same yields to some extent agriculture and fishery. Over time both the power sector and the fishery sector has become more market based, and the ground rent is close to zero. The power price is expected to increase, and then a positive ground rent will turn out in the future.

III. THE NORWEGIAN SUSTAINABLE INDICATOR COMMISSION

10. The Norwegian Government presented a National Action Plan for Sustainable development, National Agenda 21, to the Parliament in the National Budget for 2004. An official commission was asked to develop a set of indicators for sustainable development as a basis to sustainable development policy in Norway. The Commission delivered its report in 2005 (see Ministry of Finance 2005). They proposed a set of 16 indicators, and Statistics Norway was asked to prepare annual reports on these indicators.

11. The work of the Commission was based on a political document stating environmental goals, referring global and regional conventions and agreements (Climate convention, the convention on Long range Transboundary Pollution, the Montreal Protocol, the UN convention on biological diversity), and the indicator set should include information directly related to the following up of these conventions/agreements. The Commission hence based their work on a *policy oriented capital approach*. They categorized the 16 indicators along two dimensions; *Issues* (political issues cf. the National Agenda 21) and *Components* of the national wealth. The focus in the National Agenda 21, which the Commission used for policy classification, was on:

- (a) Climate, ozone and long range transported pollution (2 indicators);
- (b) Biodiversity and cultural heritage (4 indicators);
- (c) Natural resources (7 indicators);
- (d) Hazardous substances (1 indicator);
- (e) Sustainable economic development (10 indicators);
- (f) Social areas (8 indicators).

12. These 6 policy issue areas and the classification of indicators are presented in the chart on the next page (cf Ministry of finance 2005).

Table 1: Proposal for indicator set and relations to issues and components of the national wealth

Indicators		Issues			Components of the national wealth							
	Issues that the indicators shall cover	Climate, ozone and long-range-transported air pollution	Biodiversity and cultural heritage	Natural resources	Hazardous substances	Sustainable economic development	Social areas	Financial assets	Produced capital	Human capital	Natural resource capital	Environmental capital
1	Emissions of greenhouse gases compared with the Kyoto Protocol target	✓										✓
2	Percentage of land area where the critical load for acidification has been exceeded	✓	✓	✓							✓	✓
3	Population trends of nesting wild birds		✓	✓							✓	✓
4	Percentage of rivers and lakes with clearly good ecological status		✓	✓							✓	✓
5	Percentage of localities (coastal waters) with clearly good ecological status		✓	✓							✓	✓
6	Energy use per unit GDP			✓		✓				✓	✓	
7	Recommended quota, TAC actually set and catches of Northeast Arctic cod			✓		✓				✓		
8	Household consumption of hazardous substances				✓					✓		✓
9	Net national income per capita, by sources of income			✓		✓	✓	✓	✓	✓		
10	Petroleum adjusted savings					✓	✓	✓	✓			
11	Population by highest level of education completed					✓	✓			✓		
12	Generational accounts: Need for tightening of public finances as share of GDP					✓	✓					
13	Life expectancy at birth					✓	✓			✓		
14	Long-term unemployed persons and disability pensioners as percentage of population					✓	✓					
15	Trade with Africa, by LDC-countries and other African countries					✓	✓			✓		
16	Norwegian ODA as percentage of gross national income (GNI)					✓	✓					

In the column to the left in this table, the 16 core indicators of sustainable development are listed. In the heading of the table, the 16 indicators are referred to the six main policy areas in National Agenda 21.

Finally the set is related, in the table to the right, to five components of the national wealth:
- Financial capital
- Produced capital
- Environmental capital
- Human capital
A short presentation of each indicator is given in chapter 3.

13. The chart also classifies the proposed indicators along a capital approach. The commission proposed 2 indicators that were linked to financial assets and both of them were also linked to the produced capital. 7 (5?¹) indicators were linked to human capital (out of which 1 (2?) was also linked to natural resources capital. 6 (7?) indicators were linked to natural resources capital out of which 4 (6?) were also linked to environmental capital, besides one additional indicator was linked to environmental capital.

14. From this chart we find that the focus was mainly on indicators on human capital and natural resources capital. Since both economic and natural resources indicators also are of social concern, 8 indicators are classified as linked to these concerns. The Commission does not use the term social capital in their classification of national wealth; rather, they use the term social areas in the political issue dimension.

IV. THE NORWEGIAN SUSTAINABLE INDICATOR SET

15. Since 2008, Statistics Norway publishes updated figures for the *policy oriented capital approach* indicators. The indicator set is slightly revised compared to the indicator set presented by the Ministry of Finance Commission. In the next chart we present the main indicator set (for an elaborated discussion see Statistics Norway (2009) pp- 10-15, which is included in the Appendix). The indicator set now constitutes the 6 main policy areas subdivided into 18 main indicators, i.e. the indicators are still classified along two dimensions; Policy issues and components of national wealth, see figure 3.

16. From one to six indicators are presented within each of these areas (see below); 18 in total. The indicators are intended to provide important information on the condition and development of the different areas. Some of the indicators also point to critical factors in relation to sustainable development. The question of sustainable development is so complex that the 18 indicators cannot throw light on all challenges. This report therefore includes supplementary information in the form of additional indicators, cf the next chapter.

17. National wealth as described in chapter 2 is still not one of the main indicators in our indicator set. Indicator 13 in the indicator set, *Net national income per capita* is a “substitute” for national wealth in that it measures the annual income generation from the same capital approach subset of indicators. Net national wealth is the net present value of all future net national incomes. The supplementary indicators include a national wealth indicator, see chapter 2.

¹ The numbers in parenthesis is my own, since we suspect that the printed version of Ministry of Finance (2005 – page 12-13) which is included here suffered from displacement of a couple of columns in the components of the national wealth matrix

Components of national wealth						The Norwegian Indicator set	Priority areas	Policy areas						
Financial assets	Produced capital	Human capital	Natural resources capital	Environmental capital	Social capital			Natural Resources	Climate, ozone, and long-range air pollution	Biodiversity and cultural heritage	Hazardous chemicals	Sustainable economic and social development	International cooperation for sust. development and combating poverty	Social areas
						Size of spawning stock of North-Atlantic cod and Norwegian spring-spawning herring	Natural Resources							
						Irreversible losses of biologically productive areas								
						Energy use per unit GDP								
						Norwegian emissions of greenhouse gases compared to Kyoto target	Climate, ozone, and long-range air pollution							
						Emissions of Nox, NH3, SO2 and NMVOCs								
						Bird population index - population trends for breeding bird species in terrestrial ecosystems	Biodiversity and cultural heritage							
						Proportion of inland water bodies classified as clearly not at risk								
						Proportion of coastal waters classifies as clearly not at risk								
						Trend in standards of maintenance of protected buildings								
						Potential exposure to hazardous substances	Hazardous chemicals							
						Net national income per capita by sources of income	Sustainable economic and social development							
						Trends in income distribution								
						Generational accounts								
						Population by highest level of educational development								
						Disability pensioners and long-term unemployed persons in percentage of the population								
						Life expectancy at birth								
						Net national income by source. 1986-2008. 1986-2008. 1000 NOK/capita. Fixed 2008-prices	International cooperation for sustainable development and combating poverty							
						Norwegian official development assistance, in NOK and in percentage of gross national income								
						Imports from least developed countries and from all developing countris								

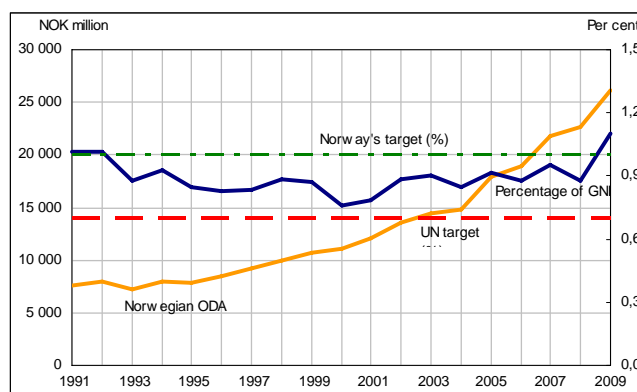
A. Critical areas

18. Many important aspects of sustainable development require both international collaboration and national initiatives: Climate changes will have a ripple effect on the resource situation, development of poverty and biodiversity, and initiatives for improving the situation must then have both an international and national basis. In this regard, international poverty can also represent a major threat to sustainable development.

B. International cooperation for sustainable development and combating poverty

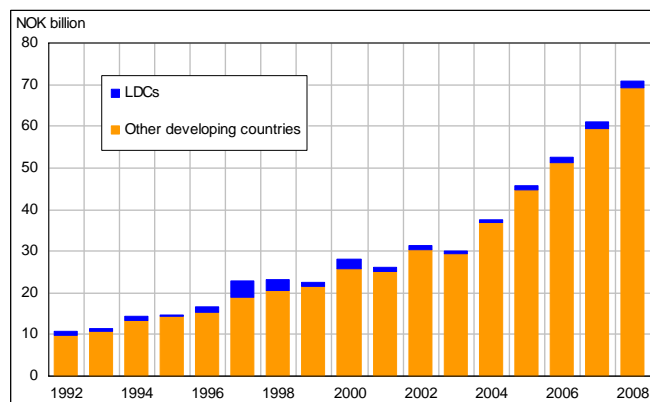
(i) More development assistance, but lower percentage of GNI

19. One of the most important challenges linked to promoting sustainable development internationally is reducing poverty. This is also the most central of the UN's Millennium Development Goals adopted in 2000. Norway gave NOK 22.6 billion in development assistance in 2008. The level corresponded to somewhat below 0.9 per cent of the GNI, just short of the Norwegian target of 1.0 per cent. The UN's target is 0.7 per cent of the GNI.



(ii) Trade with developing countries increasing

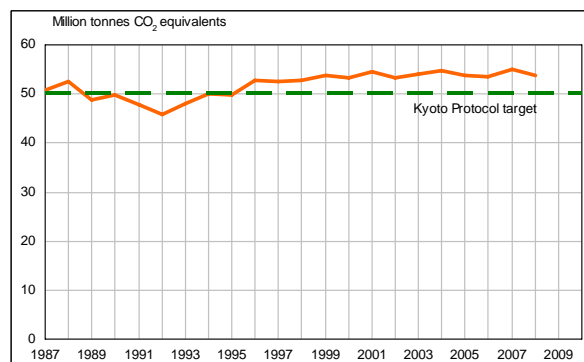
20. Since 2003, imports to Norway from developing have more than doubled. Imports to Norway from all developing countries increased by 16.8 per cent from 2007 to 2008. Imports from the least developed countries (LDC's) also increased, but only by 7.8 per cent. In 2008, imports from LDC's made up 0.4 per cent and imports from all developing countries 14.3 per cent of the total imports to Norway. Imports from China accounted for 45 per cent of imports from developing countries.



C. Climate, ozone and long-range air pollution

(i) Greenhouse gas emissions down 2.2 per cent

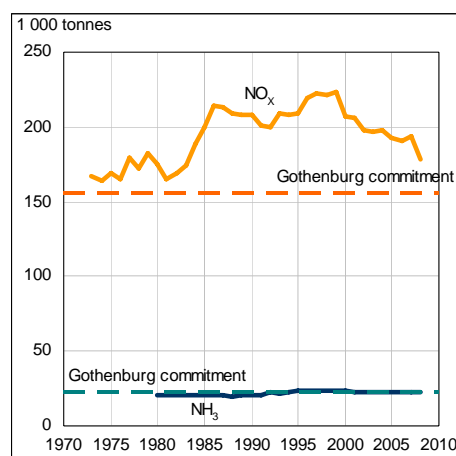
21. In 2008, greenhouse gas emissions in Norway decreased by 2.2 per cent to a level of 53.8 million tonnes CO₂ equivalents. According to the Kyoto Protocol, Norway's



annual emission quota in the period 2008–2012 is 1 per cent higher than the emission level in 1990 (a total of 250.6 million tonnes CO₂ equivalents for the whole period, or about 50 million tonnes on average per year). In order to meet the obligation, substantial purchases of emission permits from abroad will be needed.

(ii) Significant reductions in emissions of nitrogen oxides. However, the emission target is still far off

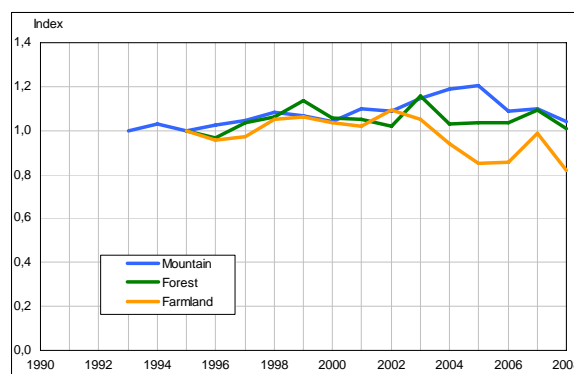
22. With regard to the majority of gases included in the Convention on Long-Range Transboundary Air Pollution, emissions have fallen and the level is close to the emission target in the Gothenburg Protocol for sulphur dioxide (SO₂), ammonia (NH₃) and non-methane volatile organic compounds (NMVOC). However, the target for nitrogen oxides (NO_x) is far off. The Norwegian emissions of NO_x (nitrogen oxides) totalled 179 000 tonnes in 2008. This is approximately 15 000 tonnes, or 8 per cent less than in 2007. To meet the obligation for 2010 in the Gothenburg Protocol (156 000 tonnes), the emissions must be reduced by a further 23 000 tonnes. Accordingly, an annual reduction almost as large as from 2007 to 2008 is needed in 2009 and 2010.



D. Biodiversity and cultural heritage

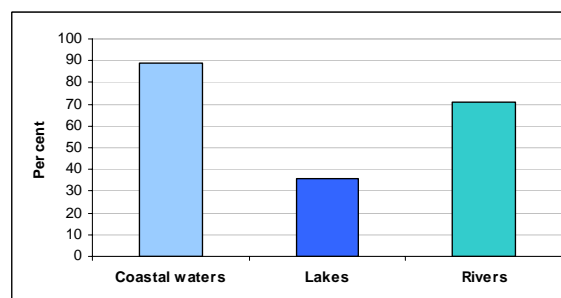
(i) Need for better data

23. There is currently no systematic, nationwide monitoring of the condition of any of the indicators for biodiversity. The figures that are presented are therefore encumbered with a large degree of uncertainty. *The development of bird populations in farmland, forests and mountains* is uncertain, even though a slight increase in mountain bird populations seems to have occurred since 1993.



(ii) A comprehensive assessment of inland and coastal waters

24. The figure shows the share of resources where there is no threat to the physical, chemical and biological state. Details show that the poorest quality of freshwater is south of the region Møre og Romsdal (West/middle coast) and the poorest quality of sea water is along the coast and fjords from the Swedish border to Rogaland (south coast).



25. Efforts are currently made to establish

nationwide monitoring systems that will improve the data basis for the indicators of biodiversity. The on-going work with the development of a Nature Index for Norway may give a valuable contribution.

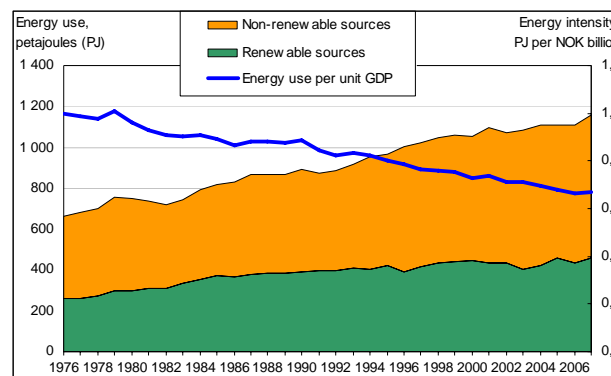
E. Natural resources

26. Norway has a high supply of energy resources, and high energy consumption per capita. A substantial part of the energy consumption is based on renewable sources, particularly hydropower. The major national expansion of hydropower is, however, over for the most part. We have passed the peak of the oil production, while gas production will last longer. A large part of the value of oil and gas is transferred from resource wealth to financial wealth through the Government Pension Fund - Global.

27. Fishing has been an important basis for settlement and economic activity throughout Norway's history. Sustainable management of fish resources implies an exploitation that does not threaten the recruitment to the stocks. Without sufficient recruitment, there is no basis for long-term, sustainable harvesting of these resources.

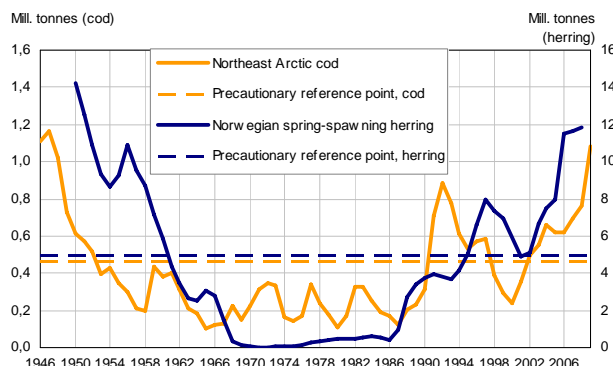
(i) Energy consumption increases, and the energy intensity is reduced

28. Norway has reduced its energy intensity measured as energy consumption per unit of GDP by an average of 1.1 per cent a year since 1976. At the same time, energy consumption has increased by on average 2.4 per cent per year. Oil production, manufacturing, heating and transport require a great deal of energy. The energy consumption index (energy/unit of production) for oil and gas production in 2008 was slightly higher than the level in 1990. Industry excluding oil and gas used about 30 per cent less energy in relation to the gross production value in the same period. The per capita energy consumption in households fell by 4.8 per cent from 1990 to 2007.



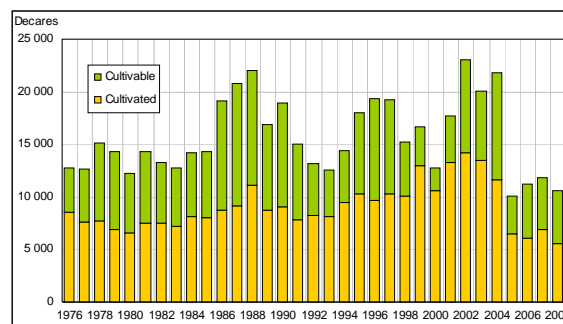
(ii) Herring and cod stocks increase

29. The spawning stock levels of two of the most important fish stocks in our waters, Norwegian spring spawning herring and North-east Arctic cod, are currently well above the precautionary level, and are thus harvested sustainably. The herring stock is now at around the same level as in the 1950s, and the spawning stock of cod has not been as large since the mid 1940s. Both herring and cod are regarded to be key species in the ecosystems in the Norwegian Sea and Barents Sea, i.e. they are crucial factors in the interaction between the species.



(iii) Conversion of farmland for other purposes

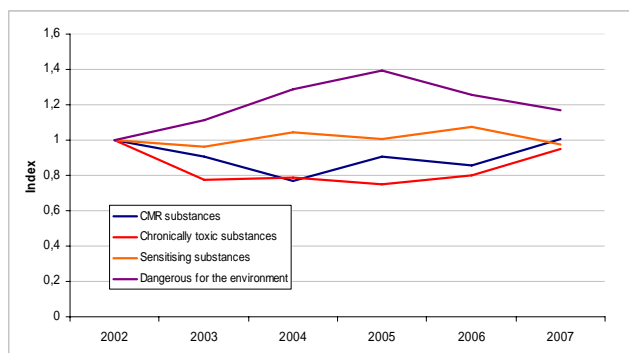
30. A total of 516 km² of cultivated and cultivable land has been converted for other purposes in the period 1976–2008. There are no figures for total irreversible losses of biologically productive areas in Norway, such as the indicator should actually call attention to.



F. Hazardous chemicals

(i) Back at the 2002 level

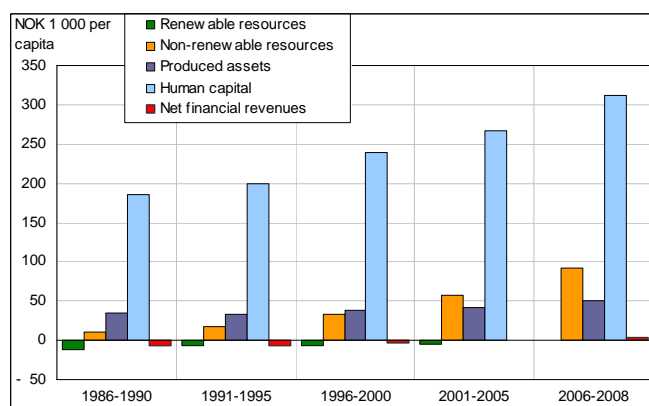
31. Emissions of the most dangerous, hazardous substances (substances that can lead to cancer, cause mutations or damage the reproduction system (CMR substances) and chronically toxic substances) fell in Norway from 2002 to 2006. However, in 2007 these emissions rose again and are now back at the 2002 level. Emissions of allergenic substances were relatively stable during the period, while the emissions of substances with specific hazardous properties increased between 2002 and 2005, and fell again until 2007. Emissions of these substances are also back at the 2002 level. However, the results should be interpreted with caution. Since the 1930s, the global production of chemicals has increased from 1 million tonnes to more than 400 million tonnes per year.



G. Sustainable economic and social development

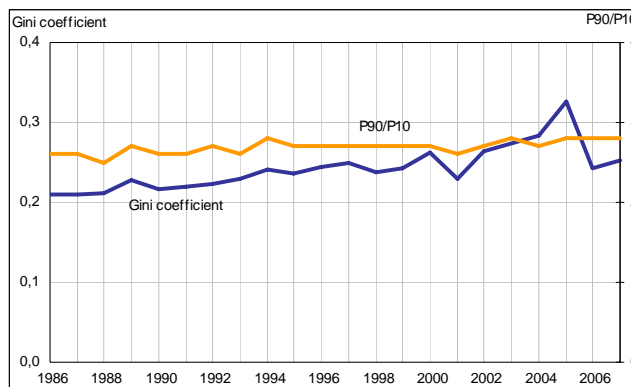
(i) Human capital crucial

32. The net national income increased considerably from 1986 to 2008, and this was related to the return on all wealth components. The extraction of non-renewable natural resources, i.e. oil and gas for the most part, is an important source of income for Norway. The significance of this source has increased from yielding 5 per cent of our income in the period 1986–1990 to 20 per cent in the period 1986–1990 to 20 per cent in the period 2006–2008. The contribution from the human capital is, however, the largest and constituted 69 per cent on average over the three years from 2006 to 2008.



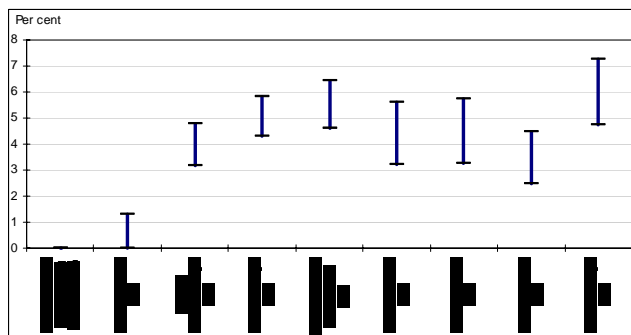
(ii) Increase in disparity

33. The Gini coefficient (a measurement of disparity) shows that the income disparity increased from 1986 to 2005. The considerable decrease from 2005 to 2006 was due to the development in the capital incomes as a result of changes in the dividend taxation. The P90/P10 index shows that those with a household income of more than 90 per cent of the population in 2007 had about 2.8 times more income than those with a higher household income than the 10 per cent of the population with the lowest income. This ratio has only seen a slight increase since 1986.



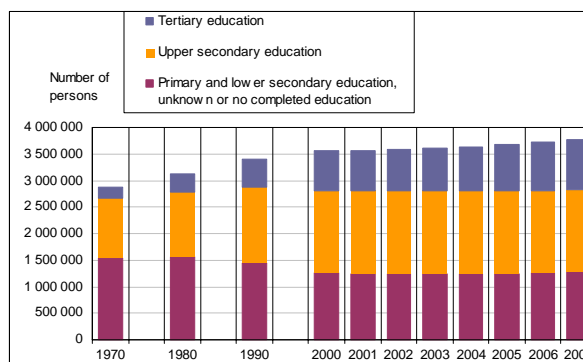
(iii) Need to tighten public sector finances

34. The estimated need to tighten the public sectors finances has increased considerably. The Ministry of Finance's generational accounts calculations in the Revised National Budget 2009 show that public sector budgets need to be strengthened by NOK 93–139 billion, corresponding to 4.75–7.25 per cent of the gross domestic product, in order to be balanced in a generational perspective. Increased life expectancy, an older population, increased use of petroleum revenues, growth in national security costs and in costs for nursing and caring activities are all factors that may weaken the generational balance.



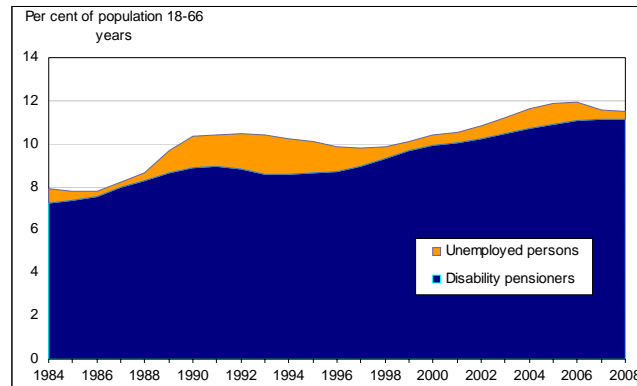
(iv) Higher level of education

35. The level of education has increased markedly in Norway in the past 30 years, and in 2007, over 25 per cent of Norwegians aged over 16 years had been educated at a university or university college. At the opposite end of the scale, the figure for those who had only completed their compulsory education has fallen by more than 20 percentage points since 1970, and is now 31 per cent. In 2006, Norway was number seven among the OECD countries in terms of share of the population with a university or university college education.



(v) More disability pensioners, and unemployment will increase

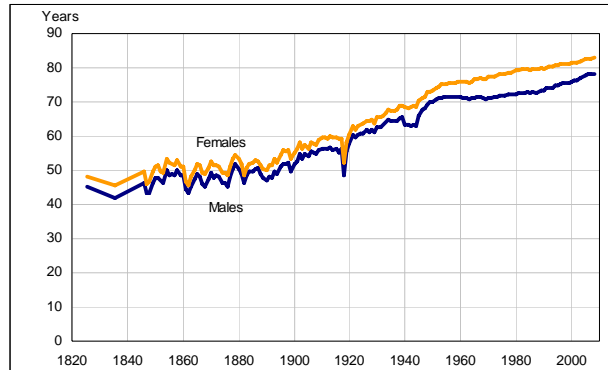
36. In an international perspective, the unemployment level in Norway is low, but the share of the population receiving disability pensions is high and growing. In 2008, 11 per cent of the population (340 000 persons) were in receipt of disability pensions, while the number of long-term unemployed was much lower; 11 000 persons. Although they are still few in number, a growing number of young people receive disability pensions. A total of 4 700 persons in the 18–24 years age group were in receipt of disability pension in 2008. As a consequence of the international financial crisis the



unemployment in Norway is increasing. According to seasonally-adjusted figures, the unemployment rate in March 2009 was 3.2 per cent (as measured by the average of the three months from February to April). Projections made by Statistics Norway indicate an increase in unemployment to a level of 4.7 per cent (125 000 persons) in 2010 and 2011.

(vi) Life expectancy increases

37. Life expectancy in Norway has been on the increase for almost 200 years. Life expectancy at birth increased with 0.2 year from 2007 to 2008 to the highest recorded life expectancy in Norway ever. Women still live longer than men, but the gender gap is narrowing. The life expectancy for newborn girls and boys is 83.0 and 78.3 years, respectively. The gender gap in life expectancy in 2008 was 4.6 years in favour of women. For more than a hundred years the gender gap was between 2.5 and 3.5 years, but it increased from the middle of the 1950s towards 1980. In the first half of the 1980s it stabilized around 6.8 years. The gender gap has since then decreased gradually to the level of today.



38. An important reason for the increase in life expectancy over time is the fall in mortality rates among infants and children. Infant mortality for both sexes was 2.7 in 2008 – the lowest figure ever recorded in Norway. The expected remaining lifetime of persons aged 62 and over has, however, also seen rapid growth in recent years. The number of people aged 67 and over will increase fast, from 617 000 in 2009 to around 1.5 million in 2060 – or more than twice the current level.

39. Calculations also show that healthy life years were 65.4 for men and 66.4 for women in 2008. This means that 13 and 17 years of men's and women's lives respectively will be limited in terms of life quality due to health problems. Despite this, surveys indicate that the elderly appear to be increasingly active and fit. Simultaneous to this, almost every third man and every

fifth woman in Norway aged over 16 years are classified as overweight. In the long term, this could lead to a decrease in life expectancy and impair the state of health later in life.

V. SUPPLEMENTARY INDICATORS

40. For several of the 18 main indicators we find it useful to supplement with more detailed indicators. This is due to the fact that within most of the areas described by the main 18 categories world is very complex, heterogeneous, and ambiguous (the sign of the change differs). A complete set of just above 50 indicators in our total indicator set is presented in Appendix B.

41. There are some interesting features with the supplementary indicators, for instance, under the category climate change we find *Atmospheric CO₂ concentration*, *Global mean temperature* and *Global CO₂ emissions*. This makes it easier to relate Norwegian emissions of greenhouse gases, that is among the main indicators, to the global state world variable climate.

42. Under the category biodiversity we present 6 supplementary indicators, as for instance the Norwegian red list for species (possible critical factors). We also include a discussion of criteria's for constructing a nature indexes.

43. Under the category Natural Resources we present 9 supplementary indicators. Some compare national energy use with world energy use (relative measures is important), and some other offer more details on different species of cod and herring.

44. Under the category sustainable economic development we present 10 additional indicators. One is the national wealth (we should probably switch between national wealth and net national income as the main indicator under this category, see the next chapter). It is an open question if all these indicators really add to the general conception of this area, or whether they are just interesting policy issue areas.

VI. AN "ALTERNATIVE PRESENTATION APPROACH"

45. As described above, the presentation of the Norwegian indicator set is along two dimensions, policy issues and type of capital. An alternative way of presenting the indicators that is more stringently "loyal" to the capital approach is presented in the next chart.

46. The heading is the 5 types of capital in the capital approach (where I have added the concern for international cooperation), i.e. these are the main

	Total national wealth						Int. coop. for sust/pove rty combat.
	Financial capital	Produced capital	Human capital	Natural Resources capital*	Environ- mental capital	Social capital	
National wealth	322' /cap	1247' /cap	8115' /cap	1412' /cap			
			Population highest level of education	Bird population index	Climate, ozon and long range air pollution		Development assistance
			Disability and long term unemployd	Inland water at risk	Emission of greenhouse gases		Import from LDC
			Life expectancy at	Coastal areas at risk	Emissions of NOx, SO2 and		
				Maintenance of buildings			Generation accounts-tighten publ budget
				Energy use per capita			
				Size of spawning stock of cod/herring			
				Irreversible loss of biologically			
			Exposure to hazardous substances				

categories. All the other indicators are supplementary and categorized under the main types of capital. The national wealth figures in the chart are consistent with the figures in “Norwegian national wealth” on page 2. This indicates then that the 8 115 000 NOK/capita for *Human capital* may be changed due to education (productivity of the labour force – cf. the assumption of 2 per cent annual growth in Greaker et al 2005), and changes in unemployment rates and life expectancy (cf pension reforms) etc. The same yields for *Natural resources capital* (divided between natural resources and environmental capital in the chart) presenting indexes for several resources (birds, water, cod, herring, biodiversity, pollution etc), which are not captured sufficiently in the national wealth calculations (cod and herring are in principle calculated among the natural resources capital, but not sufficiently? – do we double count here?).

47. From the former chart of the Norwegian indicator set in chapter 3 we find that some of the indicators are classified under several types of capital, while in the present chart I have only included them under one type of capital. This shows one of the simultaneity problems when introducing several indicators. One measure is important for the development of different types of capital – i.e. everything influences everything. This calls for a total simulation model approach. If the elements were included and the links between them incorporated in a total growth model – it would be possible to simulate and decompose the importance of each element. However, this is a challenging task.

VII. CONCLUSIONS

48. Statistics Norway has published figures for national wealth since 1993 (for 1991). After that we have calculated the development from 1985 to 2008. In 2008, *Human wealth* constituted the largest part (73 percent) while *Natural resources* constituted only 13 percent.

49. Statistics Norway publishes a main sustainable indicator set of 18 indicators. These indicators are presented as a policy oriented capital approach – although the publication does not classify indicators along the capital approach dimension – just the policy issue dimension. The main indicator in the capital approach, national wealth, is just a supplementary indicator.

50. An important part of the Norwegian indicator set is two indicators on international aid, following up on the Brundtland commission’s definition on sustainable development.

51. An alternative approach of presentation, which does follow the capital approach in a more stringent way, is easy to achieve, without losing grips with important policy issues. This approach stresses the national wealth dimension and identifies important supplementary indicators to each of the capital types in the capital approach.

52. So far we have not worked very much along the social capital dimension, although some of the indicators are relevant to the social political dimension.

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APPENDIX A

I. A DISCUSSION OF SUSTAINABLE DEVELOPMENT

1. From the Report 2009/26 from Statistics Norway, http://www.ssb.no/emner/01/rapp_indikator_utvikling/rapp_200926/rapp_200926.pdf presents an updated set of sustainable development indicators and describes the development of the indicators together with relevant supplementary information. In compiling the report we had an effective collaboration with a number of institutions, which have supplied data and assessments for the various subject areas. This has been necessary in order to ensure a high professional quality. A number of divisions and departments in Statistics Norway have made contributions to their respective specialist areas. The main responsibility for compiling the report has rested with the Division for environmental statistics in the Department of economics, energy and the environment.

A. What is sustainable development and how is it measured?

(i) The World Commission on Environment and Development

2. The World Commission on Environment and Development defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Sustainable development rests on three pillars: economic, environmental and social, which must all be satisfactorily safeguarded on a global basis. The world is complex, so a number of indicators are needed in order to throw light on development features in different areas. The indicators tell us whether development in the different areas is sustainable, or if it is heading in a more or less sustainable *direction*. Ideally, the *collective* set of indicators should indicate whether the development *as a whole* is sustainable.

(ii) Indicators and statistics

3. The indicators shall primarily show the long-term trends and call attention to future challenges, but they are also aimed at intercepting the changes that take place from one year to the next. The intention of the indicators is that they shall represent the development within a large area. An indicator therefore distinguishes itself from statistics, which show much more details in the development. The statistics might show that there is a large degree of heterogeneity with regard to the development within the area that the indicator is highlighting. With a high degree of heterogeneity, it could be said that the indicator is a poor representative for its area. The indicator is a better representative where a large degree of homogeneity is present. In addition to the actual indicator, some other aspects of the various subjects are also presented in this report in order to take account of the fact that there may be a considerable degree of heterogeneity.

(iii) More indicators or single measurement

4. One important question is whether sustainable development requires *all* indicators to point in a positive direction, and if so, whether all policy areas being highlighted with the associated indicators are equally important. In principle, consideration could be given to weighing up all indicators into one measurement of sustainability. This raises a number of complex questions, which are the subject of a great deal of discussion both in Norway and internationally.

Extensive research is still needed in some areas in order to develop good indicators. The road from research and analysis to statistics and indicators is a long one. Attempting to collectively measure the development in different areas and enter it in complicated indices appears to be almost impossible in practice, and the report does not attempt to do this.

(iv) The capital approach – national wealth

5. The committee that presented the first set of indicators for sustainable development in 2005 (Official Norwegian Report 2005:5) based its work on a *policy oriented capital approach*. Statistics Norway's work on sustainable development is closely related to the international work on the capital approach – where the point of departure is the wealth aspect or *national wealth*. The national wealth is an expression of the total national resource base and consists of human capital, natural and environmental capital, social capital, real capital and financial capital. These resources produce a yield that either directly or indirectly serves our welfare. Many of the components of the wealth can be valued, while others in practice can only be measured in physical units.

(v) Consumption and critical resources

6. Two basic questions that are related: *First*: Are we using up too much of the world's resources thereby preventing future generations from maintaining the same level of welfare? Are we practicing good housekeeping so that we can leave the earth in an equally good condition for future generations? *Next*: What resources are the most critical – is it the case for example that dwindling natural resources to a marked degree can be replaced by human knowledge? One example can help to throw light on this problem: Knowledge and technological insight can result in the same benefit being achieved with less consumption of, for example, energy resources, but does the increase in knowledge help to reduce the energy consumption or is the consumption increased due to steadily new goods being available?

(vi) Threshold values

7. Simultaneous to this, it must also be recognised that not all resources or types of capital can be substituted by another type of capital. With regard to natural and environmental capital, for example, nature's thresholds can be exceeded with irreparable results, such that the changes are irreversible. Climate changes and its consequences, loss of biodiversity and changes as a result of certain hazardous substances are examples of this. For this type of capital, the reserve or quality of the individual resources must be kept above the minimum level that corresponds to nature's threshold values.

B. Policy areas for sustainable development

8. The Norwegian strategy for sustainable development covers six policy areas²:

- (a) International cooperation for sustainable development and combating poverty;
- (b) Climate, ozone and long-range air pollution;

² The seventh subject area in the sustainability strategy "Sami perspectives in environmental and resource management" is not covered by the set of indicators.

- (c) Biodiversity and cultural heritage;
- (d) Natural resources;
- (e) Hazardous chemicals;
- (f) Sustainable economic and social development.

APPENDIX B

The full set of 52 indicators – 6 main areas, 18 main indicators and 34 supplementary indicators – the supplementary indicators in blue

International cooperation for sustainable development and combating poverty

Norwegian official development assistance, in NOK and as percentage of gross national income. 1991-2009

Imports from least developed countries (LDCs) and from other developing countries. 1992-2008. NOK billion

Climate, ozone and long-range air pollution

Norwegian emissions of greenhouse gases compared with the Kyoto Protocol target. 1987-2008. Million tonnes CO₂ equivalents

Atmospheric CO₂ concentration at Mauna Loa observatory, Hawaii. March 1958-February 2009. ppm

Global mean temperature. 1850-2008

Emission of greenhouse gases in Norway, by source. 1990-2008. Million tonnes CO₂-equivalents

Global CO₂ emissions. 1751-2006. Million tonnes carbon

Emissions of CO₂ from combustion of fossil fuels. Selected countries and regions. 2006. Tonnes per capita

Norwegian emissions of NO_x, NH₃, SO₂ and NMVOCs compared with the Gothenburg Protocol commitment. 1 000 tonnes

Emissions of acidifying substances in Norway. 1 000 tonnes acid equivalents. 1980-2008

Emissions of SO_x. EMEP region. 1980-2006 and projections to 2010 and 2020. 1 000 tonnes

Percentage of Norway's land area where critical loads for acidification are exceeded.

TOFP-values 1990-2008. Index, 1990=1

Biodiversity and cultural heritage

Bird population index – population trends for breeding bird species in terrestrial ecosystems (forest, mountain, farmland)

Important impact factors for Norwegian Red List species.

Wilderness-like areas in Norway. 1900, 1940 and 2003

Principle drawing for calculation of the Nature Index

Nature Index for middle parts of Norway.

Proportion of the area of inland and coastal water bodies and proportion of river length classified as “not at risk”. Per cent

Water regions in Norway

Percentage of Norwegian water bodies classified as “not at risk” of failing to meet the objectives of the Water Framework Directive in 2015. Inland water bodies and coastal waters, by river basin district.

Standards of maintenance of protected buildings as per May 2009. Number of buildings

Natural resources

Energy use per unit GDP and total energy use (PJ) for renewable and non-renewable energy sources. 1976-2007

Energy use in selected countries and regions. 2006. Kg oil equivalents (kgoe) per capita

Production of oil and gas, energy use in production and energy use per unit produced on the Norwegian continental shelf. 1990-2008. Index, 1990=1

Use of energy per unit value added in industry and commerce outside oil and gas production, and household energy use per capita. Indices, 1990=1

World energy use 1965-2007. Million tonnes oil equivalents

Extraction and use of energy goods in Norway. 1970-2008. PJ

Size of spawning stock of Northeast Arctic cod and Norwegian spring-spawning herring, compared with the precautionary reference points (B_{pa}). Million tonnes

Quotas and landings. Northeast Arctic cod. 1978-2009. 1 000 tonnes

Quotas and landings. Norwegian spring-spawning herring. 1978-2009. 1 000 tonnes

Size of spawning stock of North Sea herring (autumn spawners) and North Sea cod compared with the precautionary reference points (B_{pa}). 1963-2008

Size of spawning stock of Barents Sea capelin compared with the critical reference point. 1973-2008. 1 000 tonnes

Loss of cultivated and cultivable land in accordance with the Planning and Building

Act and the Land Act. 1976-2008. Decares

Hazardous chemicals

Releases of hazardous substances 2002-2007 relative to the 2002 level, split by hazard categories (index 2002=1), and releases by hazard categories in 2002 and 2007. Tonnes

Releases from dominant product categories, by hazard categories, 2007. Percentages

Releases from manufacturing industry and other industries, by hazard categories, 2007. Percentages

Concentration of short and medium chained polychlorinated paraffins in cod liver from five localities along the Norwegian coast. Ng (nanogrammes)/g lipid

Sustainable economic and social development

Net national income in NOK per capita, by sources of income. 1986-2008. Constant 2008 prices

National wealth, by type of capital. 1986-2008. NOK 1 000 per capita. Fixed 2008- prices

Trends in income distribution. 1986-2007

Real income after taxes per for persons in different categories of the income distribution. Per cent

Generational accounts: Need to tighten public sector finances as a share of GDP

Growth in employment in public services. 2007-2060. Index, 2007=1

Population (aged 16 years and over) by highest level of educational attainment

Persons in the age group 25-64 years with tertiary education. OECD countries. 2006. Per cent

Disability pensioners and long-term unemployed persons as a percentage of the population

Seasonally adjusted unemployment in selected countries. 2004-2009. Per cent of the work force

Life expectancy at birth. 1825-2008

Percentage of population with health problems that influence every day life to a great degree, by age groups and sex.

Percentage of population with different diseases, by age groups. 2008

Percentage of Norwegian population with overweight (BMI<=27). Men and women.

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