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**STATISTICS FOR SUSTAINABLE DEVELOPMENT:
A FRAMEWORK FOR SUSTAINABLE DEVELOPMENT INDICATORS (SDI)**

A report from the Joint UNECE/OECD/Eurostat Working Group
on Statistics for Sustainable Development
(WGSSD)

Statistics for Sustainable Development:

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“Many important social processes take a long time – sometimes an extremely long time – to unfold. ... In choosing what we seek to explain and in searching for explanations we focus on the immediate – we look for causes and outcomes that are both temporally contiguous and rapidly unfolding. In the process, we miss a lot (Kitschelt 1999; Goldstone 1998).”

From: Pierson (2003).

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0 Executive summary

(To be written.)

0.1 Outline of the report

1. The first next chapter provides the background for this report, outlining why is it being written and what the intended audience is. Furthermore, some definitions of central concepts (e.g. what do we mean by development, sustainable development, weak and strong sustainability, etc.) are discussed, and arguments for the need for a conceptual approach when measuring sustainable development are provided.
2. Chapter 2 goes on to give an overview of some of the existing approaches to measuring sustainable development and extracts some commonalities among these. Some of the existing indicator sets have a degree of commonalities when it comes to issues covered, although there is a great variety when it comes to number and choice of indicator. More conceptually based approaches have been established with a foundation in a capital theory of development, i.e. what is called the capital approach. Examples are work carried out in the World Bank, Canada and Norway.
3. Chapter 3 describes the capital approach to measuring sustainable development, based on the notion that sustainable development entails a non-declining social welfare over time and that this has the potential to be realised only if the total resource base, or total national wealth, is preserved over time.
4. Chapter 4 provides an outline of what kind of statistics and data systems (measurement framework) are needed in order to support an indicator set based on the capital approach, i.e. a capital-based measurement framework. It also compares some of the existing approaches with the capital approach and comes up with both a menu of sustainable development indicators and a smaller set of indicators that may become a core set for international comparisons.
5. Chapter 5 concludes with a description of some of the challenges likely to be associated with setting up an indicator system based on the capital approach, elements of a future research agenda and – last but not least – provides a brief set of recommendations to countries.

0.2 Acknowledgements

6. The OECD Statistics Directorate, together with the government of Norway, UNECE and Eurostat has provided the working group with secretarial support. Statistics Norway and the Norwegian Ministry of Finance have also given financial support to research papers produced, e.g. Greaker (2007) reproduced as Appendix 3 to this report, and to the editor.

1 Introduction

1.1 Background for the working group and the report

1.1.1 Mandate of the working group

7. Sustainable development indicators (SDIs) are used by some national governments and international agencies for monitoring progress towards sustainability goals set by national governments as well as comparing performance among countries. The Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development, henceforth WGSSD, was established by the Conference of European Statisticians (CES) in 2005 in order to provide a theoretical and conceptual framework and to structure the work on indicators better than has been the case up till now. A framework in this context is a practical set of principles and rules that allow one to select a limited set of sustainable development indicators in a coherent and consistent manner.

8. More specifically, the group was given the mandate to identify good concepts and practices in order to assist national governments and international organizations in the design of sustainable development indicator sets and in the development of supporting official statistics in the area (see Appendix 1 – for the full mandate).

9. Furthermore, the mandate says that the Working Group should:

- articulate a broad conceptual framework for sustainable development measurement. While the starting point of this work should be the concept of capital, the group should also consider other approaches to the extent the capital approach is found insufficient from a conceptual standpoint;
- identify the broad domains that good indicator sets should span;
- develop a menu of good sustainable development indicators in order to help governments and international organizations when they are designing indicator sets;
- identify a small set of indicators from the menu that might become the core set for international comparisons;
- identify basic data systems necessary for a small set of indicators and identify their possible sources (existing or new statistical surveys, administrative records, information derived from environmental monitoring systems);
- discuss the relationship between integrated environmental and economic accounts and sustainable development indicators.

10. In October 2006, the Bureau of the Conference of the European Statisticians (CES) provided, at the request of the working group, the following elaboration:

- the WGSSD is encouraged to thoroughly explore the approach based on the four types of capital - economic, natural, human, and social capital, as the basis for the measurement of sustainability. However, in each of the four capital areas, the WGSSD is encouraged to go only as far as it can in a conceptually sound manner;

- the WGSSD should limit its work to looking at existing practices in countries that have adopted policy-based approaches to the measurement of sustainable development in order to reveal commonalities, and also commonalities with the capital approaches. The group should only highlight the commonalities rather than develop recommendations; and
- a progress report on the work of the WGSSD will be reviewed by the Bureau at its meeting in February 2007. (Source: ECE/CES/BUR.2006/OCT/26, page 3)

11. The working group reported back to the Conference of European Statisticians and the OECD Annual Meeting of Sustainable Development Experts.

1.1.2 Composition of the Working group

12. The group has been open to participants from all policy making institutions and official statistical bureaus within UNECE, and as a result participation has been variable from meeting to meeting. Normally around fifty participants have attended each meeting.

13. The work of the group has been supported by UNECE, Eurostat, the OECD, the World Bank and Norway, which all have had representatives in the steering committee (SC), see below. Robert B. Smith from Statistics Canada has been the chair of the working group. From February 2007, Knut H. Alfsen from Statistics Norway, with support from the Ministry of Finance of Norway and Statistics Norway, has been assigned the role as editor of the report and has participated in the meetings of the Steering Committee. Further editorial support has been provided by ...

1.1.3 Organisation of the work

14. With such a large group, it was found useful to appoint a smaller steering committee (SC) to be responsible for work to be carried out between group meetings, meeting preparations etc. A more detailed Terms of Reference for the steering committee is presented in Appendix 2.

15. Members of the Steering Committee have been:

- Robert B. Smith, Statistics Canada and chair of the working group
- Stephen Hall, Defra, UK
- Thorvald Moe, Ministry of Finance, Norway
- Viveka Palm, Statistics Sweden
- Andrea Scheller, Swiss Federal Statistical Office
- Joachim Thomas, Federal Statistical Office of Germany
- Lidia Bratanova, UNECE
- Enrico Giovanini, OECD
- Kirk Hamilton, The World Bank
- Pascal Wolff, Eurostat

16. The Working Group has met in the following meetings:

- First meeting of the Joint UNECE/Eurostat/OECD Working Group on Statistics for Sustainable Development (Luxembourg, 3-4 April 2006)
- Second meeting of the Joint UNECE/Eurostat/OECD Working Group on Statistics for Sustainable Development (Oslo, 15-16 November 2006)

- Third meeting of the Joint UNECE/Eurostat/OECD Working Group on Statistics for Sustainable Development (Geneva, 19-20 April 2007)
- Fourth meeting of the Joint UNECE/Eurostat/OECD Working Group on Statistics for Sustainable Development (Bucharest, 8-9 November 2007)

17. The Steering Committee has met 7(8) times and generally had meetings back-to-back with the working group meetings, in addition to a few additional separate meetings (in London in January 2007, and in Ottawa in September 2007).

18. Finally, two sub-groups on existing approaches and the capital approach, respectively, were established. They have had meetings in Geneva during the Third meeting of the Working Group, and Luxembourg in May 2007 (the sub-group on existing approaches only).

1.1.4 Intended audience of the report

19. A report on indicators and statistics for sustainable development can be targeted at several different audiences; from statisticians in need of better technical manuals to policy makers and the public at large in need of a clear understanding of what sustainable development entails in terms of concrete politics and measurements. Although formally reporting to the Conference of European Statisticians and the OECD Annual Meeting of Sustainable Development Experts, this report is also clearly geared towards national policy makers and the interested laypersons with an emphasis on explaining the rationale for choice of individual sustainable development indicators. This is done by establishing a common understanding of the main forces driving long-term development and the main threats to its sustainability, and by establishing core principles for the measurement of such development.

1.2 Definitions of some basic concepts

20. The concept of “sustainable development” was popularised as a normative goal for long-term policy by the World Commission on Environment and Development (WCED)¹ in their report to the General Assembly of the United Nations “Our common future” from 1987 (WCED, 1987). Here sustainable development was defined as a development that “meets the needs of the present without compromising the ability of future generations to meet their own needs”². This definition balances two concerns: One has to do with present needs, or intra-generational equity issues. The other has to do with future generations, *i.e.* development over time. In this report the main emphasis will be on the inter-generational dimension, *i.e.* sustainable development understood as a temporal concept.

21. While imprecise, the definition agrees with the intuition that, since the term sustainable means “never-ending” or “lasting”, sustainable development is development that lasts. However, one question is what is meant by the term “development”. In other words, the problems with the concept of “sustainable development” are perhaps not so much with the word “sustainable”, but rather with the term “development” (cf. Pearce and Warford, 1993, p. 42). Thus, to understand and define sustainable development with some precision, it is important first to understand development and the longer term forces that drive it. This is

¹ The commission is commonly referred to as the Brundtland Commission after the chairperson, then Prime Minister of Norway, Gro Harlem Brundtland.

² A great number of alternative definitions of sustainable development exist.

done in section 1.2.1 below followed by a discussion of what may make longer term development sustainable in section 1.2.2.

1.2.1 What do we understand by development?

22. It seems reasonable to interpret sustainable development as developments that can continue “for ever” or at least until the end of a politically relevant time horizon, e.g. the next generation considered by long-term policy. In addition, the development 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, not least because what we consider good or bad changes over time and is also subject to different interpretations according to differences in perspectives. Thus, ecologists will emphasize the functioning of ecosystems and any development threatening their robustness will be termed negative. Traditionally, economists on the other hand have tended to measure development in terms of per capita income. However, at least since the publication of “The limits to growth” in 1972 (Meadows et al., 1972), economists have explored – inter alia – the threat to long-term development posed by the drawing down of (non-renewable) natural resources below critical levels, see e.g. Dasgupta and Heal (1979), Dasgupta (1982) and Baumol and Oates (1975) and the review volumes Oates (Ed.) (1992) and Dorfman and Dorfman (Eds.) (1977). But what if the distribution of income is skewed and the poor part of the population is getting poorer even while the average income increases? Some people will hesitate in calling this (a positive) development. Others will highlight the state of education and health in the society as important factors in meeting basic needs. Furthermore, education and research provide creation of knowledge, skills and capabilities allowing greater individual choice and freedom and as such are an important part of (a positive) development. Finally, institutional arrangements and state of governance have important ramifications for individual freedom and choice as well as longer term development in general, and should, according to some, be an essential part whereby the nature of development should be judged.

23. What this diversity of perspectives reflects is that individuals and societies differ when it comes to defining welfare or wellbeing. While it is easy to agree that a positive development is a change over time that somehow increases the welfare, the precise definition of what constitutes a positive development is harder to identify. However, despite different perspectives, norms and viewpoints, it is fruitful to ask the question where the welfare comes from, and what drives development?

24. One step in such an analysis is to recognize that welfare can be considered as the outcome of consumption, understood in a comprehensive manner. This consumption consists of consumption of both goods and services that are produced and traded in markets (food, housing, bicycles and cars, cinema tickets, professional health care, etc.) as well as goods and services that are produced in households for own consumption or directly harvested from nature and thus non-marketed (some recreational services, air, etc. are some examples). The next step is to ask how these consumption goods and services are produced – in other words what is the basis for welfare and the development of the services that are its basis.

25. Whether the goods and services we consume are produced by financial and real (produced) capital together with labour, or gathered or extracted from natural resources, it is reasonable to view them as stemming from a total *resource or capital base*³. That capital base is composed then of both *produced (or real) capital* in the form of machineries, buildings and

³ A common definition of capital is that capital is any resource that has to be reserved in advance, so that production may take place that will only bear fruits later. Often it is nature itself which has reserved the capital in the form of natural resources. Additionally, produced capital is created by saving and investments. (Marshall, 1961).

other types of infrastructure, of *natural capital* in the form of renewable and non-renewable material resources, as well as ecosystems providing services like waste absorption or provider of scenery, etc. In addition we reap the benefit of our own labour and our competencies and skills. This is part of *human capital* and is therefore also an important part of societies' resource base. In addition, our societies are more than the sum of the individuals living there, with its network of social relations, its institutional structure and its rule of law and other governmental services ("good governance"). It can thus be argued that institutional or *social capital* is important for development.

26. The *total national wealth* thus consists of financial, produced (real), natural, human and social capital. Managing the total national wealth in a manner that sustains it over time, measured in real terms per capita, allows us to potentially secure long-term and positive development. Technological change is also an important determinant of longer term development, and to what extent it can be sustained over time. This can (perhaps) be seen as a manifestation of human capital.

27. One may of course fail in utilising the resource base effectively and instead waste the resources on wars or conflicts, but without a stable or increasing resource base, development will in the long run deteriorate and sustainable development will not be possible. This observation opens up an interesting avenue when it comes to measure sustainable development, described in Chapter 3.

28. This interpretation and explanation of forces of development in welfare, is a close parallel to classical and neoclassical theories of economic development. According to John Hicks (Hicks, 1965, ch. 4), the first simple growth models were constructed by the fathers of classical economics: Adam Smith and David Ricardo. The notion of capital as a framework for, or cause of, development goes back to the seminal work of Adam Smith from 1776 (Smith, 1776) who recognised that saving and investments are keys to economic development. It is fundamental that one has to save in order to have a surplus in which to invest in maintaining or enhancing the capital stock. Probably the first systematic and rigorous treatment of this topic is found in Ramsey (1928).

29. Later 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" formalising production functions or growth equations explaining the forces driving economic development (Solow, 1988).

30. The notion of human capital was introduced in the literature by T.W. Schultze and Gary Becker in the 1960s, see Becker (1964). In Romer's models of endogenous growth of the 1980s and 1990s (Romer, 1987, 1990, 1994), 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 state of art has been summed up in a paper written for the WGSSD, see Appendix 3 (Greaker, 2007).

31. The role of natural resources or natural capital has perhaps been intuitively understood for a long time. Land figured prominently as a factor of production in Ricardo's works. In neoclassical development theory it was perhaps (implicitly) assumed that natural resources were not limited, and/or could be substituted by other forms of capital, or could be preserved (above critical levels) by technological improvements.

32. There exists a large literature discussing the theoretical foundations of national wealth accounting. Here we will limit ourselves to a few central contributions.

33. The book “The limits to growth” (Meadows et al., 1972) initiated the early literature. In the book the authors predicted that the world will run out of non-renewable resources, and that the world population may collapse through famine and other disasters.
34. A large response in a number of important research papers followed, see for instance Hartwick (1977) and Dasgupta and Heal (1979). Solow (1986) shows formally that Hartwick’s rule implies the maintenance of aggregate national wealth or “some appropriate defined stock of capital...” at a constant level over time.
35. Pearce and Atkinson (1993) applied sustainability criteria to national accounting numbers. They calculated net investment corrected for resource depletion, or as it has come to be called *genuine savings* and investments, in 18 different countries. The genuine saving indicator can be seen as a direct application of the Hartwick rule. Applying this rule strictly would imply that none of the natural resource rents should be consumed. Rather it should be re-invested in other types of capital. Later contributions to this research, to mention just a few, are Hanley et al. (1999) and The World bank (2005). The main point from this research is that a necessary, but not sufficient, condition for longer term development to be sustained is that genuine savings – a broader measure of savings including exploitation of natural resources, must be positive measured in real terms and per capita. For a survey of development of this research, see Atkinson, et al. (1997). The World Bank now publishes genuine saving estimates for some 140 countries, and finds generally that the level of genuine savings is positive for developed countries, but not for all developing countries⁴.
36. In conclusion, there exist theories and explanations for (economic) development going back several hundred years in time. They are all focused on the capital base of societies as the main force behind development. Access to assets is therefore a main issue in understanding development. What has changed over time is a growing recognition of the fact that the capital base consists of more than money and produced capital. Thus, human, natural and social capital has in turn been included as important factors in explaining development⁵. That they also should be important in determining whether a development is sustainable or not is therefore hardly surprising.

1.2.2 What do we understand by sustainable development?

37. Sustainable development is about the development of social welfare *over time*. Thus, the time dimension is crucial; sustainable development is a dynamic concept that mainly relates to inter-generational issues. It is a development *path* that is or isn’t sustainable. Any given single situation located in time (e.g. an intra-generational issue) may be difficult to characterise as sustainable or not. The reason is that several alternative development paths may follow from a single situation. Some of these paths may be sustainable, that is continued indefinitely, and others may not.
38. This is not to say that the current situation – or intra-generational issues more broadly – is of no relevance for welfare and wellbeing. For instance the disparity between the rich and the poor in today’s world is clearly a problem. Thus, the key issue is how poverty can be eradicated while at the same time ensuring an inter-generational sustainable development globally.

⁴ It should be noted though, that the World Bank’s estimates, by its own admission, fail to include several important sources of potential unsustainability.

⁵ For an analysis of the link between wealth and social welfare, and useful insights into why we need to care about measures of (national) wealth, see P. Samuelson (1961) and P. Dasgupta (2001).

39. Societies clearly have preferences for equity or distributional issues both within and between nations. The distribution of assets⁶ across societies will therefore have an effect on the social welfare and thus be a relevant issue when it comes to determine whether a development can be characterised as sustainable or not.

40. From the above it follows that indicators for sustainable development mainly should consist of time series, showing trends, developments, paths, that may be deemed to be sustainable or otherwise. Development over time requires, as stressed above, savings that can be invested in various capital types.

1.2.3 Weak versus strong sustainability

41. Pearce and Atkinson introduced more precision and rigour by defining the concept of *weak and strong sustainability* in an article from 1993 (Pearce and Atkinson, 1993). *Weak sustainable* development is a rule specifying that the overall capital stock per capita, or total national wealth per capita, should not decline over time in real terms. Substitution between the various stocks of capital is possible in this definition of sustainable development. Drawing down one stock of capital, e.g. by petroleum extraction, can be compensated by investing in another stock, e.g. real capital or human capital. Technological progress, whereby we manage to get the same service out of less material resources, is thus an example of substituting natural resources by human, and perhaps social, resources.

42. *Strong sustainability*, on the other hand, assumes that such substitution is limited, and that there is at least a minimum requirement for maintenance of each type of capital stock. In particular societies are more dependent on ecosystem services than is commonly recognised. Food production is an obvious example where loss of biodiversity makes the whole system steadily more vulnerable. A relatively stable climate is another 'service' that tends to be taken for granted, but which is hardly substitutable by another type of capital.

43. The distinction between the two types of sustainability may seem clear-cut. However, in reality it is more a matter of degree than of absolutes. We will return to this below when we discuss the role of accounting prices in valuing the various components of the resource base, see section 3.1. Thus, strong sustainability requires that for instance natural capital is not reduced below minimum or irreversible levels.

1.3 Measuring sustainable development: On the need for a conceptual approach

44. Defining and measuring sustainable development are two different things. Difficult as it has proven to be to agree on a precise and unique definition of sustainable development, it should come as no surprise that it has proven just as hard to agree on a method to measure the degree of which a certain development is sustainable or not. The quest for sustainable development indicators should be viewed in light of this. As the name implies, indicators should indicate something rather than giving comprehensive information about all aspects of the object under study (in this case sustainable development). As such the main task of the indicators should be to provide and communicate signals of potential unfavourable developments or future threats. Of course, the indicators will usually be based on statistical information of one type or another, but the pursuit for comprehensiveness or even representativeness need not be fulfilled to the same degree that one expects from statistics or

⁶ The distribution of assets is clearly more relevant to sustainability than distribution of income.

accounting systems⁷. Indicators do not stand alone, but should be seen as part of the overall information system constituting official statistics. The overall system should come much closer to providing all that is known about an issue than the indicators themselves will be able to do.

45. Still, the indicators need to be based on a sound theoretical footing. To quote from Dasgupta (2001):

“It is necessary to have a tight, analytically sound framework from which to proceed to practical decisions. Along the way, corners will have to be cut and qualitative judgements have to be made. But having the correct framework at the back of one’s practical mind is good practice. It enables the evaluator to recognize when a corner has to be cut and it forces him to search for good ways to do it. The danger is to dismiss the framework with the shrug of one’s practical shoulders. If one does that, all sort of *ad hoc* considerations can be expected to creep in, such as the interests of powerful groups in society.” (Dasgupta, 2001, p. 178)

1.3.1 Agenda 21 and the call for sustainable development indicators

46. While, indicators of sustainable development was discussed in the environmental economics literature as early as the 1970’s, a renewed call for such indicators was formulated in one of the main documents coming out of the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992; Agenda 21.

47. The Agenda 21, the Rio Declaration on Environment and Development, was adopted by more than 178 Governments at the Rio de Janeiro meeting in 1992. The full implementation of Agenda 21, the Programme for Further Implementation of Agenda 21 and the Commitments to the Rio principles, were later strongly reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa from 26 August to 4 September 2002, ten years after the Rio de Janeiro meeting.

48. On the need for new indicators the Agenda 21 states that (cf. paragraph 40.4):

“Commonly used indicators such as the gross national product (GNP) and measurements of individual resource or pollution flows do not provide adequate indications of sustainability. Methods for assessing interactions between different sectoral environmental, demographic, social and developmental parameters are not sufficiently developed or applied. Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems.”

49. Further on, Agenda 21 calls for:

“A) Development of indicators of sustainable development

- 40.6. Countries at the national level and international governmental and non-governmental organizations at the international level should develop the concept of indicators of sustainable development in order to identify such indicators. In order to promote the increasing use of some of those indicators in satellite accounts, and eventually in national accounts, the development of indicators needs to be pursued by the Statistical Office of the United Nations Secretariat, as it draws upon evolving experience in this regard.

B) Promotion of global use of indicators of sustainable development

⁷ The linkages between indicators, accounting and statistics are discussed in more detail in Chapter 4.

- 40.7. Relevant organs and organizations of the United Nations system, in cooperation with other international governmental, intergovernmental and non-governmental organizations, should use a suitable set of sustainable development indicators and indicators related to areas outside of national jurisdiction, such as the high seas, the upper atmosphere and outer space. The organs and organizations of the United Nations system, in coordination with other relevant international organizations, could provide recommendations for harmonized development of indicators at the national, regional and global levels, and for incorporation of a suitable set of these indicators in common, regularly updated, and widely accessible reports and databases, for use at the international level, subject to national sovereignty considerations.”
(see: UN, 1992)

50. Since 1992 several nations and intergovernmental organisations have answered the call of Agenda 21 and developed sets of indicators of sustainable development. Some have even done so in several versions. A description of many of these sets and their commonalities are discussed in Chapter 2 below. Here, we only note that the result has been a profusion of different indicator sets with a lack of a common structure or theoretical basis. This has led to some frustration among professionals about the state of affairs, i.e. lack of international comparability, and no progress in this field when it comes to convergence and harmonisation of approaches. Hence, there has been a request for developing a conceptual approach to the topic of sustainable development indicators that could give coherence to the work and provide a mean for greater harmonisation in the international effort in developing sustainable development indicators (SDIs). This is indeed the central element of the mandate of the working group. A benchmarking of countries with regard to their sustainability, and not only on short-term measures like GDP per capita, could also provide a sound shift in focus to more long-term structural issues in each country, and thus help to secure policy formulations taking longer term constraints to development into account.

1.3.2 Characteristics of indicators

51. This forms the background and rationale for this report. In addition, indicators should be seen as a proper part of the official statistics. This implies that measuring sustainable development by statistical means, in particular by use of indicators, should bear the same “hallmarks” as other official statistical information, viz. follow the fundamental principles of official statistics:

- It should be objective in informing long-term policies, e.g. national strategies for sustainable development.
- It should have a theoretical underpinning.
- Consistency over time and national boundaries should be secured.

52. In particular, indicators should provide information that directs attention to potential challenging, long-term issues, more than providing complete data for analysis of the problems. In fact, by identifying sets of indicators of interest for the long-term development, it could point to areas where the existing statistical system has deficits today and is in need of further development. The aim should be that the overall system should come much closer to providing all that is known about an issue than the indicators alone. Use of the indicators themselves should therefore be seen as more of a mode of communication of changes than a provider of all that is known about an issue, e.g. why changes are taking place. In doing this, indicators should still adhere to certain norms peculiar to indicators:

- The indicators should be *transparent*. That is, the statistical basis for the indicator should be easy to explain; preferably the indicators should be based directly on available observational data or statistics in order to avoid methodological discussions about weighting or other computational algorithms for construction of indicators.
- The indicators should as far as possible be *comparable across nations/regions* in order to facilitate comparisons and identifications of good practices in policy areas of relevance to sustainable development.
- The indicators seen as a set should as far as possible be able to *communicate a total picture* with regard to whether the development is sustainable or not. This implies that the indicator set should not be too large. Changes in single indicators that are part of large indicator sets are often difficult to interpret and, therefore, can lose their relevance.
- The indicator set should reflect the impact of *policies*, e.g. the indicators should as far as possible within the framework of the indicator set be related to concrete long-term policy targets, pointing out achievements deficits in specific policy areas when this takes place.

53. Finally, it is worth noting that relatively large resources in today's industrialised societies are used to analyse and, where possible, understand development in short-term trends. News in all media reports on day-to-day fluctuations in market conditions, and statistical offices publish and comment on monthly, quarterly and annual statistics. A fair number of consultancy firms and research institutes make a living from describing and explaining short-term movements in a range of mostly economic indicators. An important objective when we talk about sustainable development is to redirect some of the attention of policy makers to longer term trends and developments of crucial importance when we are concerned with the long-term viability of our societies.

1.4 On the geographical scale for sustainable development indicators

54. We need to confront the question of what geographical unit or scale is relevant when trying to build an indicator set for sustainable development. It is true, of course, that a sub-global geographical unit cannot be said to be sustainable if the globe as a whole is deeply unsustainable. While partial improvements are possible in selected areas, in the long run everybody will have to be aboard the 'development ship' if the trip is to last for a long time, i.e. be sustainable. On the other hand political actions and the potential to change course is predominantly a regional, national or even local privilege. For this reason it makes sense to try to measure whether they, as a region (e.g. EU), nations or local provinces, are behaving in a manner that supports or detracts from the sustainability of the globe. This is then the twin aim of the regional, national or local sustainable indicator sets; to show whether or not they are managing their own territories in a sustainable manner and whether they contribute or not to global sustainability.

2 Overview of existing approaches to measuring sustainable development

Written by Stephen Hall with support from Julie Hass and Pascal Wolff

2.1 Introduction and brief history of existing indicators history

55. The 1992 Rio Conference on Environment and Development was a major impetus behind efforts to develop indicators for measuring progress towards sustainable development. After this conference the United Nations Commission on Sustainable Development (UNCSD) was established - with one its tasks being to monitor countries' efforts in developing and using sustainable development indicators.

56. UNCSD developed a set of sustainable development indicators and a number of countries and Eurostat (Eurostat 1997, European Commission 2001) tested the proposed methodologies, the results of which led to revisions to the indicator set.

57. The OECD also looked at how to measure sustainable development and focused on integrated economic, environmental and social frameworks that could be used for statistical development of indicators for sustainability (OECD 2004).

58. In addition to these international efforts many countries have developed their own sets of indicators for measuring progress towards sustainable development. The 2002 Summit on Sustainable Development in Johannesburg was an important milestone since a number of countries developed their own sustainable development strategies and related indicator sets in preparation for this summit meeting. Increasingly sets of indicators have been established to be used to assess progress towards goals in national plans or strategies for sustainable development.

59. In many countries the national statistical institutions have played a key role in the development and evaluation of sustainable development indicators. However, in several cases, other government ministries or agencies, and non-governmental organisations have led or have been strongly involved in the development phase. In many cases a consensus building process was used to reach agreement on a set of indicators encompassing the different perspectives of various actors in society.

60. Approximately 22 countries started by testing the SDIs proposed by the UNCSD (UN 1996), including countries in Africa (Ghana, Kenya, Morocco, South Africa, Tunisia), Asia and the Pacific (China, Maldives, Pakistan, Philippines), Europe (Austria, Belgium, Czech Republic, Finland, France, Germany, United Kingdom) and the Americas and the Caribbean (Barbados, Bolivia, Brazil, Costa Rica, Mexico, Venezuela) (UN 2001). This work often showed that some of the proposed indicators were not that well oriented to national needs. One result was that countries started developing their own sustainable development indicator sets. Switzerland, the United Kingdom, Germany, Sweden, and Belgium, to name a few in Europe, were some of the countries to establish indicator sets in the late 1990s. Since then the regular publication and revision of these sets in connection with national sustainable development strategies has been part of these countries monitoring of national sustainability. The United Kingdom has perhaps had some of the longest experience with indicator sets

connected to policies, the first being in 1996, the second in 1999 and the third in 2005, since when updates have been published annually.

61. Few countries have explicitly developed indicator sets based around the concept of capital. However preceding most of the indicator development by ten years or more there has been development theories emphasising investment and saving. An important contribution was *The Limits to Growth* in 1972 (Meadows et al., 1972) which emphasised the need to monitor the use of non-renewable resources. Natural resource accounts were developed for Norway in 1978 leading to capital-based sustainable development indicators established by the World Bank, Canada and Norway based on resources, national wealth and genuine savings.

2.2 ‘Policy-based indicators’ – the predominant approach

62. The establishment of sustainable development indicators has arguably been for many countries and institutions a key opportunity to bring environmental issues higher up the policy agenda, to set them alongside economic and social issues. The sustainable development indicators have arguably also been instrumental in promoting the concept of sustainable development in a much clearer way than can be achieved through the expression of sustainable development strategies alone.

63. In many cases the relationship between the indicators and policy is very strong – with the policy framework in effect determining the indicators. Whilst there may be concerns about having indicators closely aligned with policy documents and thus strictly speaking lacking political independence, their very strength has been their relationship with policy in that policy makers have seen them as being relevant and useful and effective for communication.

64. Behind the policy frameworks there has often been intensive, rigorous and consultative consideration given to how sustainable development should be defined and how it might be structured. In turn the indicators themselves have often been open to consultation and scrutiny by stakeholders.

65. It can be speculated that had attempts been made to develop indicators independently of policy then in many cases the indicators may never have been established, as it was the policy debate that provided the framework allowing indicators to be identified in a practical and pragmatic way.

66. In several countries and institutions the indicators are presented as an integral part of a sustainable development strategy, whether identified explicitly or generically. Commitments are made to report regularly on the indicators, and in some instances commitments go as far as taking action if the indicators are not reporting favourable trends.

67. With the indicators dependent on a policy framework there is perhaps less transparency than if the indicators were defined as an independent exercise. There are very few examples of where countries or institutions have provided a full and detailed explanation of how they have elaborated and selected their indicators. Instead the indicators are seen to some extent as simply falling out of the policy framework. However, in reality behind the choice of indicators has been extensive consideration of available data and concerns about how best to present the indicator so as to communicate the issue behind the policy effectively. This does mean however that in most cases it is difficult to identify a framework designed specifically for the indicators.

68. Where a framework has been expressed explicitly it may be very strictly based on the policy objectives in the national strategy, or it may take the form of the ‘Pillars’ approach,

where the pillars are usually 'economic', 'social' and 'environmental', or it may be influenced by the Driver-Pressure-State-Impact-Response (DPSIR) approach developed by the OECD as a means of breaking down issues. In a very few cases the framework may be explicitly based on the capital concept.

69. An obvious drawback to the indicators being so strongly aligned with policy is that if the policy framework changes then the indicators may have to follow suit. This is particularly illustrated by the UK example, where there have been three sustainable development strategies and three associated indicator sets. However the reality is that in such cases the changes to the indicator sets may be on the periphery and at the core there is reasonable consistency between the different generations of indicators. In addition, it would be wrong to set the indicators in stone, when refinements would be beneficial in terms of coverage or understanding.

70. Hitherto there has perhaps been only minor consideration given to international comparability in the development of national indicators sets. This is inevitable both in terms of differing priorities between countries and pragmatically in terms of data available at the national level. There is a debate to be had in terms of the need for and the benefits of having international comparability across sustainable development indicators, when for the issues that are of global or regional importance, the indicators are likely to be broadly consistent in any case (for example most if not all sustainable development indicators sets will include an indicator on greenhouse gas emissions).

71. That said, within the EU there is inevitably some convergence in the indicators used. This is for two reasons, firstly - and more obviously - as newer Member States develop their indicator systems, they are likely to be influenced by the indicators adopted by the EU. Secondly and less obviously, the indicators used by the EU have been developed through engagement with Member States and those with well-established national indicator sets have been influential in the direction taken to establish the EU indicator set.

2.3 Status, themes and commonalities in existing indicator sets

72. Eurostat commissioned a study 'Improvement of Structural and Sustainable Development Indicators', which includes an analysis of national sustainable development strategies, national indicators and the relationship with indicators established for EU. The objectives of the study include:

- Systematic analysis of the coverage of the priorities set by the national sustainable development strategies through indicators
- Systematic comparison of the use of sustainable development indicators between Member States with the priorities and indicators used at the EU level.
- Identification of trends in the use of indicators by Member States.

73. The study covers analysis of the current 25 Member States and additionally acceding, candidate and European Economic Area countries. Particular challenges for this study include determining when a national document is a sustainable development strategy and when a set of indicators are sustainable development indicators. The size of indicators sets also varies considerably between countries, and a number of countries have both a 'headline' set and a wider 'core' set of indicators. In addition the declared number of indicators may be an under-

statement, where individual indicators consist of several independent component indicators. All these issues make comparative analysis very difficult.

74. The study found that the number of national sustainable development indicators ranged from 12 in France to 190 in Italy, if component indicators were taken into account.

Table 2.1 Number of indicators in national sustainable development indicator sets.

	Total	of which quantitative	of which qualitative
Austria	95	92	3
Belgium	45	45	0
Czech Republic	100	99	1
Denmark	119	115	4
Estonia	95	92	3
Finland	35	35	0
France	12	12	0
Germany	28	28	0
Greece	70	70	0
Iceland	56	56	0
Ireland	36	33	3
Italy	190	190	0
Latvia	187	186	1
Lithuania	75	75	0
Luxembourg	27	27	0
Malta	24	19	5
Netherlands	32	32	0
Norway	16	16	0
Romania	13	13	0
Slovakia	71	71	0
Slovenia	71	71	0
Sweden	91	91	0
Switzerland	163	163	0
United Kingdom	147	145	2

75. Analysis has been undertaken to identify commonalities both in terms of the themes in national indicator sets and specifically in terms of indicators. Based on analysis of 15 countries (for which comprehensive analysis was possible) and the EU set, there are eleven broad themes that are clearly most commonly used as a basis for the indicator sets, see Table 2.2 (the number of national and EU indicator sets including these themes are shown in the last column).

Table 2.2 Most common themes in indicators sets .

Rank	Themes	Number of indicators sets*
1)	Management of natural resources	16
2)	Sustainable consumption and production	15
3)	Climate change and energy	15
4)	Transport	14
5)	Social inclusion	14
6)	Education	14
7)	Research & Development, Innovation	14
8)	Socio-economic development	13

9)	Public health	13
10)	Good governance	13
11)	Global dimension	12

*based on themes where 10 or more countries reflect them in their indicator sets.

76. There are a further 12 broad themes evident in various sets, although they are not so commonly used.

77. Analysis of the commonalities in indicators is also made difficult because indicators that are essentially covering the same issue may be expressed in different ways (eg as growth rates, per capita, per land area etc.) but could be essentially covering the same thing. As far as possible the Eurostat study has attempted to clarify the extent to which indicators are commonly used. This analysis has been undertaken comprehensively for 17 countries, combined with the EU and United Nations sustainable development indicators. The indicators have only been identified in terms of their broad commonality and not necessarily in the specifics of how they have been expressed. The most commonly used broad indicators are listed below in Table 2.3 (the number of countries and institutions using the indicators are shown in the last column).

Table 2.3 Most common broad indicators in national and institutional indicators sets.

Rank	Broad indicators	Number of indicator sets*
1)	GDP per capita	18
2)	Emissions of greenhouse gases	17
3)	Education attainment	16
4)	Municipal waste collected and its disposal	15
5)	Official Development Assistance	14
6)	Unemployment rate	14
7)	Life expectancy	14
8)	Biodiversity and number of protected species (birds, trees)	14
9)	Share of energy from renewable sources	13
10)	General government gross net debt	12
11)	Research & Development expenditure	12
12)	Risk of poverty	12
13)	Air pollution	12
14)	Emission of ozone precursors	12
15)	Employment rate	11
16)	Organic farming	11
17)	Mortality due to selected key illnesses	11
18)	Energy consumption by sectors	11
19)	Energy use and intensity	11
20)	Water quality	11
21)	Investment share of GDP	10
22)	Freight transport by mode	10
23)	Area of protected land	10
24)	Fishing stock within safe biological limits	10
25)	Intensity of water use	10

*based on indicators where 10 or more countries or institutions have adopted them.

2.4 Assessment and conclusions

78. There is a wide range of experience in the development and use of sustainable development indicators across countries. With some exceptions, the indicators have been established to support a national strategy and to that extent at least are policy-related indicators and an independent statistically-driven framework is not explicitly expressed.

79. However behind the policy development there has often been a great deal of consultation and theorising as to how to frame sustainable development for each country or institution.

80. The number of sustainable development indicators and the approaches used by each country vary considerably, which makes identifying commonalties in approaches difficult. However there are some broad themes and indicators that are most commonly used, which may provide a basis for comparison with a framework and a set of indicators developed explicitly using a capital-based approach.

References: to be added

3 An analytical approach to sustainable development: The capital framework

3.1 A theoretical outline of the capital approach to measuring sustainable development

81. Within the framework of the United Nations, the European Commission, the International Monetary Fund, OECD and the World Bank, there have for a long time been discussions on how to complement and extend the economically oriented national accounts to better capture the importance of natural resources and the environment. Some industrialised countries took the lead on this in the 1990s and organised the so-called London group⁸. One of the results so far is the UN handbook on System for Environmental and Economic Accounts (SEEA, 2003). Though the SEEA was not conceived primarily as a framework for measuring sustainable development, the handbook notes this as one a possible application of the system. Three different conceptions of sustainable development are described in the handbook, with the capital approach noted as the one to which the SEEA is best suited. Sustainable development from a capital approach is characterised as follows in the handbook:

“Sustainable development is development that ensures non-declining per capita national wealth by replacing or conserving the sources of that wealth; that is, stocks of produced, human, social and natural capital.” (SEEA, 2003, p. 4)

The rationale for this definition can be found in economic growth theory.

82. Classical development theory, briefly mentioned in Section 1.2, is strongly focused on investment and capital as central determining factors for economic growth. While traditionally restricted to economic markets and productive assets, it has recently been extended and broadened in such a way that it is made relevant also for the question of how to secure a sustainable development according to the SEEA definition quoted above.

83. Sustainable development implies non-declining per capita welfare over time. Welfare in turn, while difficult to observe and measure with objectivity and precision, is generally viewed to be a function of consumption. Here, consumption must be understood in a broad sense, i.e. covering both consumption of marketed as well as non-marketed goods and services. All of these goods and services can in turn be viewed as being produced from resources or capital. Production (and hence consumption) can therefore be seen as a function of capital and the way we chose to allocate the capital through the working of societies institutions (Dasgupta, 2001). Welfare is therefore, indirectly, also a function of how assets are distributed. In this context distributional rules and outcomes can be viewed as a manifestation of social capital.

84. Some argue that capital is perhaps not the most appropriate term when we talk about the resource base of a nation (Czesany, 2007). Given its long history in economics, it may give a misleading connotation since some forms of capital (human and social) cannot be treated in complete analogy with physical or financial capital. For instance, human capital in its current meaning is what used to be called human potential or human resources, while social capital resembles the notion of social cohesion and social institutions.

⁸ See: <http://millenniumindicators.un.org/unsd/envaccounting/londongroup/default.asp>

85. There are at least three important reasons why we still find the capital concept useful. First, it has proved to initiate interdisciplinary discussion of development and brought together scientists and policy analysts from various areas. Thus, it provides a common ground for balancing economic, social, and environment objectives. Second, the capital conceptualization gives an important insight in that the development of society is not stochastic or random. Furthermore, it explicitly states that if there is an “investment” in capital formation instead of current consumption, it is more likely to enhance the well-being in the future. In other words, if we use too much capital for current consumption, we may seriously diminish the level of future well-being. And third, there is a long standing research literature presenting us with a rigorous analytical framework based on the concept of capital.

86. It can be argued that distributional or equity issues should be included separately at this point as these are seemingly not easily captured by the capital approach. Social capital may however be strongly influenced by the current degree of fairness in the distribution of resources in a society. After all, social welfare is not only determined by the total capital base of a society, but also by how this wealth is distributed among the members of the society in question. This follows from the fact that societies care about equity or distributional issues. An unfair distribution of resources can deteriorate trust, institutions and other aspects often associated with social capital and essential for a well-functioning and welfare generating society. The question of equity thus relates to the topics of how to measure social welfare. In trying to do so, one is forced to aggregate welfare measures across individuals in order to arrive at some sort of total welfare measure. This is probably impossible to do in an objective and methodological sound way. In fact, this fundamental problem is one reason why an indicator approach to measurement is preferable and that the indicators should try to capture the size and state of the resource base. It is the working group’s opinion that equity issues are possible to capture with the capital approach framework.

87. The concept of a nation’s total resource or capital base is sometimes termed the *total* or *comprehensive national wealth* of the nation. Care should be taken in using this concept, however, as *national wealth* is sometimes also used for a monetary valuation of the productive assets in an economy. In this report the term *total national wealth* is used in a broader sense, as a term designating the total capital base of a nation, including tangible as well as non-tangible capital; including all types of capital giving rise to consumption possibilities that in turn gives rise to social welfare, or wellbeing of people. It should be stressed that it is the effect on welfare of a particular type of capital that gives that particular capital asset a value. The (marginal) value of a unit of extra capital is what is called the *accounting price* of that particular type of capital (Dasgupta, 2001). Given that the valuation is at the margin, that is of the last unit of capital, the figure for total wealth may not convey much meaning by itself, but changes or differences between values has meaning, for instance differences in contributions from different types of capital, differences over time or differences among countries.

88. Traditional types of capital like financial assets and physical (real or produced) capital in the form of machinery, buildings and other physical man-made infrastructure, are included in the national wealth. Similarly, the natural resources we use, whether renewable or non-renewable, are included in the concept of national wealth. Less tangible types of natural capital not sold in markets must also be included however, as it is now done in modern theories of environmental economics. This is partly related to nature’s provision of environmental services like absorption of our wastes and provider of recreational services. In addition services related to our competencies and skills (often termed human capital), must be part of the total capital base or our national wealth. Finally, our societies are more than the sum of individuals. Thus, we have created laws, institutions and governmental structures

regulating our lives, and myriad of networks that link and regulate our interactions with others in ways that clearly enhance our welfare. This highly intangible type of infrastructure in civilized societies giving rise to allocation rules is sometimes termed *social capital* and at other times referred to as *institutions*.

89. Summarising, we may partition the wealth of a nation into components consisting of:

- Financial and real (produced) capital.
- Natural capital.
- Human capital.
- Social capital.

90. Put in symbolic terms we thus have:

$$TNW = p_R R + p_N N + p_H H + p_S S$$

where TNW denotes total national wealth, R , N , H and S is real, natural, human and social capital, respectively, and the p 's are associated theoretical accounting prices, or shadow prices, which are defined as the welfare effects of a marginal change in the corresponding types of capital. The accounting prices should in theory reflect the scarcity of the various resources, but also the degree of substitutability among the various types of capital as well as distributional and institutional arrangement affecting the welfare effects derived from the resources. Thus, a fishing boat (a piece of real capital) is not much worth without fish in the sea (part of natural capital). Finally, it should be noted that the value of a resource quite frequently depends on the location of the resource. A fishing pond may have widely different values in a developing and a developed country, for instance. Thus, a lot of information of importance to sustainable development is conveyed by the accounting prices, if we only knew how to determine them!

91. Fortunately, economic theory tells us that, under certain conditions, observed market prices are fair estimates of the theoretical accounting prices. That is, market prices of a number of assets reflect the welfare effects of the same assets. This includes cases where the assets are bought and sold in free markets where nobody have undue market power, where the external effects of the assets are negligible, etc. While these conditions seldom are perfectly fulfilled, the market price can probably serve as a good estimate of the accounting price in most cases where the asset in question is traded.

92. However, many, if not most, of our total national wealth consist of assets that are not traded. Then other solutions will have to be found. We will return to this in e.g. section 3.3. Here we only note that from a purely conceptual point of view, (changes in) total national wealth (TNW) is a very good candidate for being a sustainable development indicator. This is really not very surprising given the definition of the accounting prices. The total national wealth indicator is actually constructed to capture (changes in) in society's potential to provide social welfare.

93. What is achieved by focusing on the capital base or total national wealth when it comes to measure sustainable development? Five points seem worth putting forward (in addition to the more general points mentioned in paragraph 85):

94. First, a capital based approach to sustainable development is built on well developed theories of economic development. This provides for a stable theoretical foundation for the approach.

95. Second, while welfare or well-being is difficult to measure with objectivity and precision, the national wealth may be simpler to quantify (although, as we will see, not without problems). What we lose by this change in focus is of course the direct link to sustainable development; preservation of the national wealth is not enough in itself to secure a preservation of welfare, although it could be argued that it is a necessary condition.

96. Third, by framing the question of sustainable development as a question of preserving the total national wealth, we have created a finite ‘universe’ which we want to measure. Thereby, by following the capital approach it is possible to assess whether the indicators for sustainable measurement leave out or not important and relevant issues (I.e. are all relevant types of capital captured by the indicator set?). This would be very much more difficult to assess without an all-encompassing framework limiting the issues that would treat sustainable development.

97. Fourth, by focusing on capital, or rather it’s development over time, a long-term focus in policy making is perhaps more likely to be assured. This is because management of capital stocks is by nature a long-term issue. While many flows may be turned on and off over relatively short periods, it takes time to change a stock. Politicians are thus by this approach invited to consider long-term structural changes in our societies as these are the phenomena that may threaten the sustainability of the development.

98. Fifth and final, the capital approach is ‘scalable’ in the sense that it may work on several different geographical scales (see also section 1.4). It makes sense both at a global, regional and a national scale to measure or indicate the status of the total (national) wealth and to follow this over time. However, also at the local scale communities can ask questions of how their ‘local wealth’ (i.e. capital base) is composed and whether or not it is managed in a way that may secure (partial) sustainable development at this scale. A stronger focus on the welfare generating basis of a community may make it easier to formulate a long-term strategy for securing sustainable development for the community. The capital approach thus represents a viable and useful conceptual framework for sustainable development indicators at all levels.

99. In the reasoning above we have translated and simplified the question of sustainable development to a question of whether we manage the total capital base – the total national wealth – is managed in a way that secures its maintenance over time. Thereby, the focus in the sustainability debate has been sharpened since the issue of sustainable development has been put into more concrete terms, i.e. a question whether our real, natural, human and social 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 a difficult point of whether, and to what extent, the various wealth components can be expected to substitute for each other as far as welfare effects are concerned. This question is further discussed after a brief description of the various types of capital that constitute total national wealth.

3.2 Description of types of capital

3.2.1 Real (produced) capital

100. Real or produced capital refers to produced machinery, buildings and infrastructure like roads, harbours and airports, etc. Financial capital, e.g. ‘money in the bank’ or other assets that can be converted into goods and services on short notice, is usually included in the concept of real capital as it often is converted to ownership of real capital.

101. The value of the real capital is recorded in the national accounts, and it is a common assumption that the observed price of this type of capital is a fair reflection of the welfare effects or the accounting price of real capital. In practice there are of course huge uncertainties in the reported numbers.

3.2.2 Natural capital

102. Natural capital refers to the earth's natural resources, land and the ecological systems that provide life-support services to society and all living things. In its discussion of the capital approach, the SEEA (2003) characterises natural capital as follows:

- “Natural capital is generally considered to comprise three principal categories: natural resource stocks, land and ecosystems. All are considered essential to the long-term sustainability of development for their provision of ‘functions’ to the economy, as well as to mankind outside the economy and other living beings.”

103. Thus, this broad category of natural capital therefore covers both material non-renewable natural resources like land, coal, oil and gas, minerals, sand and gravel etc. and conditionally renewable resources like forest, fish, water falls used for hydro power production and wind, to mention some. These are all resources exploited mostly for sale on markets, and their valuation in monetary terms is therefore a relatively straight forward exercise.

104. In addition natural capital covers ecosystems and other natural systems able to provide various services to mankind. Borrowing the classification scheme used in the Millennium Ecosystem Assessment (2005), natural capital may be divided into the following categories:

- Provisioning (food, fresh water, wood and fiber, fuels, minerals,...)
- Regulating (climate, flooding, disease, cleaning of water, air and soil,...)
- Cultural (Aesthetic, spiritual, educational, recreational, ...)

105. Material resources like minerals, timber, fish, hydropower, etc., belong to the Provisioning category above.

106. When it comes to the Regulating category, it covers services like absorption of unwanted by-products from production and consumption; exhaust gases from combustion or chemical processing, water used to clean products or people, discarded packaging and goods no longer wanted, etc.

107. Cultural services are sometimes called *amenity functions* and affect mankind only (or at least are the only ones measurable to us in human terms).

108. The Millennium ecosystem assessment (2005) illustrated the many linkages between ecosystem services and human welfare as in Figure 3.1.

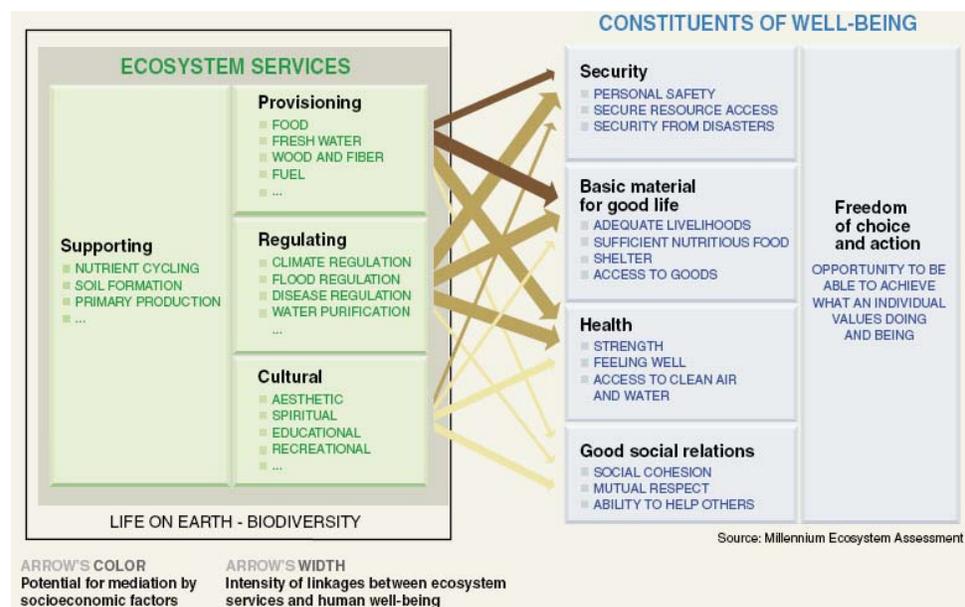


Figure 3.1. Classification scheme from the Millennium Ecosystem Assessment (2005). The figure depicts the strength of linkages between categories of ecosystem services and components of human well-being that are commonly encountered, and includes indications of the extent to which it is possible for socioeconomic factors to mediate the linkage. (For example, if it is possible to purchase a substitute for a degraded ecosystem service, then there is a high potential for mediation.) The strength of the linkages and the potential for mediation differ in different ecosystems and regions. In addition to the influence of ecosystem services on human well-being depicted here, other factors—including other environmental factors as well as economic, social, technological, and cultural factors—influence human well-being, and ecosystems are in turn affected by changes in human well-being.

109. Examples of services are nature’s absorptive capacity for waste products that otherwise would cause pollution damages, e.g. providing sinks for greenhouse gases like CO₂, and recreational services of many kinds. Most importantly are the services provided by ecosystems allowing food to be produced. This depends on, among a lot of factors, a minimum amount of biodiversity in the ecosystems, a factor which therefore is an essential part of the natural capital. The valuation of these kinds of services is often extremely difficult, and for this and other reasons seldom captured in a monetarised aggregated natural capital indicator.

110. The problems of valuing natural capital (e.g. determining the accounting prices) are as varied as the resources themselves. For most of the material resources, market prices exist. However, they seldom reflect negative externalities emerging from the exploitation of the resources. For instance, timber extraction often comes at the expense biodiversity preservation, soil protection and other environmental services provided by the same trees that give us timber. To arrive at the accounting price, the market prices will have to be corrected for these kinds of negative impacts. The sinks and service functions of the natural capital is often un-priced in the market. Here, special methodologies must be employed, like contingent valuation or hedonic pricing, in order to be able to estimate the accounting prices. Finally, in a fair number of cases it turns out to be practically impossible to find reliable and objective accounting prices. The many dimensional services of biodiversity may be such a case. Thus, the non-market part of natural capital should be measured by a few additional indicators in physical terms.

111. Overall it is fair to say that accounting for natural capital is not yet operational in the way that real and financial capital are⁹.

3.2.3 Human capital

112. Human capital is sometimes defined as an individual’s collection of human resources, including personal abilities, knowledge, skills, time, and energy. Human capital is thus about capital residing in individuals. Some define it as “the stock of economically productive human capabilities” (Bahrman and Taubman in World Bank, 2006, p.89) highlighting the economic market value of these capabilities. Others define the concept as “the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being.” (OECD, 2001 p.18), thus placing more weight on the welfare aspect. Gary Becker, who was among the first ones to use the term “human capital,” viewed education, on-the-job training and health as components of human capital with consequences for earnings and economic productivity (Becker, 1993). Becker’s book *Human capital* (Becker, 1964) became a standard reference for many years¹⁰.

113. Today, the economic importance of knowledge and skills is widely recognised both within labour economics (for individuals’ income), growth theory and business. At the same time, many see the personal wellbeing effects and social effects of learning as being as important as the economic ones. The literature on human capital, therefore, focuses on several different economic aspects, as well as its contribution to society in general and aspects of individual wellbeing.

114. It could be distinguished between the economic and the wider social benefits on the one side and between the private and the public benefits of human capital enhancement on the other (See Table 3.1)¹¹.

Table 3.1 Taxonomy of human capital benefits.

	Private benefits	Public benefits
Economic benefits	I	II
Wider social benefits	III	IV

115. The private economic benefits are at the core of the original human capital theory (quadrant I in the table). It is a well-supported thesis that better-educated people are more likely to be at work, and if economically active, are less likely to be unemployed. Several studies indicate that an additional year of schooling is associated with, on average, between 5 and 15 per cent higher earnings, though the variations among countries may be quite high. Similarly, data from IALS (OECD and Statistics Canada, 2000) show that education, literacy, experience, parent’s education and the use of native language account for between 20 to 50 percent of the total variations in the labour market earnings.

116. In addition to the benefits captured by individuals, investment in human capital may yield benefits to the economy at large (quadrant II). The collective economic impact should,

⁹ See Vemuri and Costanza (2006) for a brave effort in measuring the impact of various types of capital on social welfare.

¹⁰ Becker won the 1992 Nobel Prize in economics for extending economic theory to aspects of human behaviour which had previously been dealt with only by other social sciences.

¹¹ The next 10 paragraphs or so are taken from or based on a Working Paper developed for this Working Group by Czesany (2007).

in principle, be identifiable in the rate of economic growth, but in practice the impact has been difficult to confirm and quantify. According to a recent OECD work:

“the improvement in human capital has been one of the key factors behind the growth process of the past decades in all OECD countries, but especially so in Germany (mainly in the 1980s), Italy, Greece, the Netherlands and Spain where the increase in human capital accounted for more than half a percentage acceleration in growth with respect to the previous decade” (OECD, 2000).

117. For OECD countries as a whole the implication is that one extra year of full-time education (corresponding to a rise in human capital by about 10 per cent) leads, on average and in the long run, to an increase in output per capita of between 4 and 7 per cent (OECD, 2001). Yet, such conclusions are inevitably intensively questioned. For instance, Korea has seen a dramatic increase in the educational attainment of the labour force. Yet this dramatic expansion has not been translated into an equally dramatic effect on the growth rate of the economy. Still, it can be argued that the potential for development may have increased.

118. Thus during the last ten years or so, growth researchers have bounced from identifying quite dramatic effects of education on economic growth to calling into question the existence of any effect at all. Recent research is placed somewhere in between these two extremes, but perhaps leaning closer to the findings that education has a major impact.

119. In addition, there is a wide range of non-economic benefits of human capital. Using controls for income, race, social status and other variables, the research has shown that education tends to be correlated with:

- better health;
- lower crime and delinquency rates;
- higher civic participation, volunteering and charity giving;
- promotion of education to next generation;
- higher rates of self-reported happiness.

3.2.4 Social capital

120. Many of the existing national and international efforts to produce sustainable development indicators stem from dissatisfaction with traditional measurement systems based on purely economic concepts of wellbeing. The notion of social capital is the most recent development in the thinking about capital. Nowadays social capital is a very important term. It has been proposed as the answer to a wide variety of problems, so it is sometimes claimed that the word means “all things to all people”. Indeed, the history of the social capital idea is amazing. The current extensive research on social capital contrasts sharply with the long neglect of social aspects in the development theory. Until the 1990s, the major theories of development held rather narrow, often even contradictory, views of the role of social relationships in economic development. In the 1950s and 1960s, for example, modernization theory regarded traditional social relationships and ways of life as an impediment to development (Woolcock 2000).

121. Neo-classical and public choice theories – the most influential in the 1980s and early 1990s – assigned no distinctive properties to social relations per se. These perspectives focused on the strategic choices of rational individuals interacting under various time, budgetary and legal constraints (Woolcock, 2000: 77). In short, in economics the term has been ignored during the heyday of neoclassical economics and rational choice theories because it involves ideas difficult to handle in these frameworks: trust, norms of reciprocity,

networks, civic engagement, and formal and informal rules or institutions. So the idea of social capital – the explicit statement that social relationships positively matter - is certainly important both in theory and policy improvement in development thinking.

122. The usage of the concept of social capital can perhaps allow a bridging of some of the orthodox divides among disciplines. On the other hand it may lead to confusion since many various aspects and elements are used under the umbrella of social capital; the point is approaching at which social capital comes to be applied to so many events and in so many different contexts as to lose any distinct meaning.

123. While human capital is conceived as individual, social capital refers to features of social organization and institutions such as networks, norms, and social trust that facilitate coordination and cooperation that enable collective actions for mutual benefits. Social capital is thus an analogue to the stock of produced capital from the neoclassical growth model in economics. In the late 1990s, the concept became more respectable than previously, with the World Bank devoting a research programme to it and with its currency in Robert Putnam's 2000 book, *Bowling Alone*¹². The World Bank discusses economic and sociological aspects of social capital in Dasgupta and Serageldin (2000) and OECD has analysed the institutional aspect of social capital arguing that the sustainability of institutions, and in particular of those attending to the social needs of individuals, is important to achieve sustainable development.

124. There still seems to be significant conceptual vagueness associated with the concept of social capital (see separate Box for some attempts at definitions). Social networks, laws, institutions and even culture are some key words associated with social capital. Still, Dasgupta (2003) concludes that "Though they are related ... social capital, trust, culture and institutions are different kinds of objects." In fact, there is probably broader agreement on what social capital does, than what it is.

125. Whatever the conceptual merits of social capital, it clearly represents great challenges when it comes to measure both investments in, and the actual stock of, social capital.

¹² See also a shorter journal article Putnam (1995)

Box: Some definitions of *Social capital*

“...features of social organisation, such as trust, norms [or reciprocity], and networks [of civil engagement], that can improve the efficiency of society by facilitating co-ordinated actions.”

Putnam, Leonardi and Nanetti (1993) *Making Democracy Work: Civic Traditions in Modern Italy*, Princeton University Press, Princeton, USA.

“...the institutions, relationships, and norms that shape the quality and quantity of a society’s social interactions.”

World Bank (2000) *What is Social Capital?* from www.worldbank.org/poverty

“...the rules, norms, obligations, reciprocity and trust embedded in social relations, social structures and society’s institutional arrangements which enable members to achieve their individual and community objectives.”

Narayan (1997) *Voices of the Poor: Poverty and Social Capital in Tanzania*, World Bank, Washington D.C., USA.

Source: Graham Hobbs (2000): What is Social Capital? A Brief Literature Overview, Downloaded from http://www.caledonia.org.uk/soc_cap.htm 29.3.2007

3.3 Substitutability among types of capital. *Weak* versus *strong* sustainability

126. Given that the total national wealth consists of the four types of capital discussed above, the question arises how to quantify the stocks and whether it is possible to aggregate these measures into an overarching measure of total national wealth, for instance measured in monetary terms. Pearce and Atkinson (1993) introduced the concept of *weak sustainability*. Weak sustainability is a rule specifying that the overall capital stock measured in real terms per capita, or national wealth 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. *Strong sustainability*, on the other hand, assumes that substitution is limited, and that there is a minimum requirement for maintenance of (critical levels) e.g. the natural capital stock. For a fairly recent survey of this literature, see Atkinson et al. (1997).

127. If substitution possibilities are high and the accounting prices of the various capital stocks are available or possible to estimate, a very convenient and intuitively understandable indicator for sustainable development would be total national wealth per capita or rather changes in this quantity often denoted genuine investment or saving. This would be an indicator of sustainable development on par with GDP as an indicator for economic development. Thus, a clear recommendation is that whenever feasible, capital assets should be valued in utilitarian or monetary terms¹³.

128. Unfortunately, there are several reasons why this is infeasible and impractical in general, some of which were hinted at in the previous section. As it is argued below, there are clear-cut cases where substitution can be denied on technical grounds. Also, if the impact of economic development on e.g. the environment is becoming less and less marginal, as a number of scientists believe, then that clearly limits the scope for substitution. And since our

¹³ This is also in accordance with the recommendation from the National research Council of the National Academies in the USA, see Abraham and Mackie (editors) (2005).

economic and scientific knowledge is limited, not only total aggregated national wealth and its long-term prospects need to be monitored – but also the key capital components.

3.3.1 Critical resources

129. It is recognized that that the various components of national wealth cannot without difficulty and of necessity be replaced with each other. In other words, it is not so that for instance the services our societies receive from the environment, which may be considered as dividends of the 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 important example one may consider a fundamental asset such as a reasonably stable climate. If the climate is destabilised by increased greenhouse gas emissions, the basis for our civilisation in the long run may be threatened in a fundamental sense, almost irrespective of our material wealth. Getting to grips with the challenge of climate change is therefore a fundamental prerequisite for sustainable development *regardless* of what is happening to other types of capital and the indicator for economic wealth in particular, see later section 3.4.1. Similarly, we now know that biological diversity is a fundamental condition for the maintenance of several central ecosystems' production of services for the benefit of all. Without a minimum of biological diversity, the services of central ecosystems may be significantly reduced with very adverse consequences for *inter alia* food production. Social cohesion is also essential and related to what we loosely associate with social capital. A global destabilisation of civilisations as we know it, perhaps because of nuclear conflicts, would certainly destroys all hopes of development.

130. However, the existence of critical (or essential) resources with limited possibilities of being substituted by other resources is itself not an absolute argument against using total national wealth as an indicator for sustainable development. The reason is as follows. As outlined in section 3.1 total national wealth is composed by:

$$\text{Total national wealth} = \sum_i p_i K_i$$

(i = Real capital, Natural capital, Human capital, Social capital)

where p_i are the accounting prices reflecting the welfare effects of an additional unit of capital type i . These accounting prices are not constants, and will increase for capital types that are essential and getting scarcer, while they will decline for other resources. It will therefore be increasingly difficult to compensate for the use of critical resources. In a similar way, the limited substitutability of a resource will make it difficult, and even impossible, to compensate for the use of this resource after a while. The dynamic of the accounting prices thus capture both the aspects of criticality and substitutability. In theory, therefore, total national wealth is a valid indicator for sustainable development even when the capital base consists of critical and non-substitutable capital types (Mäler, 2007).

131. The practical problem is, however, how to measure or estimate the correct accounting prices. This requires an understanding of how access to additional capital of various types affects the welfare of individuals and how this can be translated into a measure of social wellbeing. This is important knowledge to acquire and as such should be high on the research priority list. We must admit, however, that much remains to ascertain today (see section 3.3.3). Left with this lack of knowledge, a reasonable course is to supplement the wealth indicator with specific, physically based indicators for those types of capital for which we lack a quantifiable valuation, e.g. accounting prices. These indicators could either reflect changes in physical accessible resources or changes in the accounting prices.

3.3.2 Ethical considerations

132. 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.

133. We shall not pursue this matter here, but only note that for some (perhaps many), nature has an intrinsic value outside and in addition to the direct welfare that use of natural resources may generate. If this is not captured in the accounting process of the assets, this will be an important reason why it is not sufficient to ensure that *total* national wealth is being maintained. We also have to maintain certain components of total national wealth at or above certain minimum levels for it to be possible to secure sustainable development. It is therefore necessary to monitor the development of key resources and the main individual components of national wealth separately.

3.3.3 System complexity

134. 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. Due to hysteresis effects in the climate system like melting of the northern tundra with release of large quantities of methane – a strong greenhouse gas – there probably exists so called tipping points above which it will be very difficult to reverse further global warming. The exact position of those tipping points is however not known today. In the words of Arrow et al. (2004):

“Nonlinearities in ecosystem dynamics imply the presence of serious downside risks related to the losses of natural capital. Central estimates of the shadow prices for natural capital are likely to be too low if one only considers central cases rather than the entire distribution of potential outcomes from losses of natural capital.”

135. Similarly, the multitude of man-made chemicals that escape into the 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 ecosystem 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.

136. These forms of incomplete knowledge mean that estimated accounting prices are not sufficient to provide signals of unsustainable development, and provide an additional reason why key individual elements of the national wealth, and not only the total value, are important.

3.3.4 Practical problems in valuation

137. Even though (rough) estimates of national wealth are now sometimes produced by some national statistical agencies in OECD countries, it is well known that there are many practical problems associated with this. One is the limited scope of many of the estimates, most often covering only produced and financial capital. Another problem, more acute when the estimates are broadened to also include for instance natural capital, is related to the fact that 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 (the accounting price) should reflect how the relevant element could contribute to the welfare. However, it is difficult to estimate these so-called accounting prices, especially if the services are not traded in perfectly functioning markets. Chapter 7 of the SEEA 2003 provides an overview of valuation methods and problems related to the different methodologies proposed in the valuation of natural capital. Again, certain individual ecosystem 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 (accounting) prices of several wealth components.¹⁴ Thus, as already alluded to, we need additional indicators – often in non-monetary terms – for an over all assessment of sustainability.

3.4 Indicators based on the capital approach

138. At the beginning of this chapter we argued that total national wealth (TNW) valued in accounting prices, i.e. by the welfare effect of an additional unit of the different capital types, in theory is a good indicator for measuring sustainable development. The following sections showed why there are numerous *practical* difficulties in actually measuring the accounting prices.

139. Nevertheless, extending the monetarisation and aggregation of components of the total national wealth as far as possible into an indicator of market based *economic wealth* is an important statistical task. It is important here to make clear the distinction between the conceptual indicator Total national wealth (TNW) based on a complete set of assets and accounting prices, and the practical indicator, let us call it economic wealth (EW), based on estimates of only some of the assets and accounting prices. For instance, non-marketed goods like good companionship or the pleasure of an aesthetically well constructed city-scape are all well beyond what is included in the narrower and mostly market based economic calculation of our wealth.

140. Even though the practical indicator Economic wealth (EW) only partially can cover what properly belongs to Total national wealth, and although the estimated accounting prices will be imperfect, clearly an indicator like EW belongs to a set of indicators of sustainable development based on the capital approach. The shortcomings of EW relative to TNW will, however, make it necessary to supplement with other indicators in order to be able to give a reasonable picture of the total national wealth. These additional indicators should be selected in such a way that they indicate the expected welfare effects of changes in key components of national wealth. The strategy should therefore be to choose additional indicators that best reflect the value, defined as the welfare effects, of the various components of total national wealth.

3.4.1 Economic wealth (EW)

141. The economic wealth indicator EW is usually estimated on the basis of a procedure that is a variant of the following. The starting point is a decomposition of *gross national income* (GNI) as recorded in the national accounts into contributions from different types of capital as follows:

¹⁴ For interesting recent work on direct measures of the largest capital component, human capital, see Hui Wei (2004) and Mads Geaker (2007).

GNI =

- i) Resource rents from renewable natural resources +
- ii) Resource rents from non-renewable natural resources +
- iii) Return on produced and financial capital +
- iv) Return on human, social and other forms of natural capital

142. The value of a capital asset is usually reckoned as the total discounted economic income accruing from its use over time. With respect to natural resources this is usually referred to as a stream of *resource rents* or extra ordinary income earned from resource exploitation. The resource rent can be interpreted as the extra income one obtains from having the right to utilize a (scarce) natural resource.

143. The value of fixed capital is usually taken from the national accounts. In order to calculate total return one use the same rate of return as we use for the resource rents calculations, i.e. the average return to capital for all non-natural resource industries in that particular year. Further, net income from financial wealth is also given in the national accounts. Lastly, since GNI itself is reported in the national accounts, we can estimate the return on intangible capital residually (point iv) in the GNI decomposition):

$$\text{Return on intangible capital iv) = GNI - i) - ii) - iii)}$$

144. Clearly, the residual also compromises all kinds of positive or negative externalities between capital, technology and labour with effects in the market; in particular, it will pick up all the growth in GNI that cannot be explained by increased factor usage.

145. In order to calculate the economic wealth from the decomposition of GNI, one must evaluate to what extent the contribution from a type of capital in a given year can be continued in the following years. With respect to the renewable natural resources, information about the stock of the resource is crucial. To the extent that the stock is kept constant or increasing, we can assume that this year's resource rent is the best prediction for the resource rent in the coming years. On the other hand, if the stock is decreasing (for fish under a critical value), the renewable resource must be treated as a non-renewable resource and an "extraction path" based on the harvest for the actual year must be calculated.

146. With respect to non-renewable resources, reserve estimates can be used to construct extraction paths based on current production and an *a priori* assumption that the extraction path is declining (especially towards the end). Estimates of future extraction cost, i.e. intermediates, labour and real capital, are usually based on last year's national accounts. Hence, one usually implicitly assumes that cost savings due to technological progress will be exactly counterbalanced by cost increases due to smaller reserves.

147. Future market prices for the resources will have to be assumed, constructed or predicted. With all of these assumptions in place, economic wealth (EW) can be estimated as:

$$\text{EW = i) present value of future resource rents from renewable natural resources + ii) present value of future resource rents from non-renewable natural resources + iii) present value of future contribution from human, social and other forms of natural capital + iv) current value of fixed capital and net financial wealth as given by the national accounts.}$$

148. Clearly, economic wealth accounting as described above has many shortcomings. First and foremost, EW is a measure only of the capital base that contributes to market-based income. While market income is an important contributor to social welfare, it is far from the only way in which it is created. Welfare is also created by "consuming" flows of goods and services from non-market assets, such as breathtaking scenery on a smog-free day, positive

relations with one's loved ones and friends and the personal ability to pursue self-fulfilling hobbies or sports. We need measures of these non-market assets both because they are important in and of themselves, but also because we want to be sure that in the pursuit of market income we are not eroding the capital base from which we derive non-market welfare. To the extent that this was true, gains in market income could be misleading in isolation as an indicator of sustainable development.

149. The second reason why EW is insufficient as a measure of sustainable development is that it makes a rather strong assumption about the substitutability among different forms of capital. If EW were to stand alone as an indicator of sustainable development, society would have to be indifferent to the mix of capital assets it possessed. People would have to be convinced that they were as well off with very little natural capital but a lot of human and produced capital as with a lot of natural capital and little human or produced capital, assuming that the total value of the asset portfolio was the same in both cases. Such indifference would hold only if there was perfect substitutability between different forms of capital. While perfect substitutability may exist between some forms of capital at the margin, it mainly does not apply in the limit (i.e., complete loss of a certain category of capital assets is nearly certain to lead to welfare losses) and it does not even apply at the margin for some, critical, forms of assets.

150. Thirdly, the estimate of EW is sensitive to assumptions about future prices¹⁵. This may seemingly make EW unsuitable as an indicator of sustainable development. In fact, the main value of EW as such an indicator resides in the possibility of making it clearer where the economic wealth of a region, a nation or even a smaller area, is coming from. That is, how much do the various capital types contribute to the economic wealth, and are there signs of mismanagement of some (or all) of these assets. This allows decision makers to focus on key capital components of importance to economic wealth. In addition, developments of the capital components over time may show whether economic development is taken place at the expense of a deterioration of parts of the resource base.

151. Thus, despite the obvious shortcomings, an estimate and description of economic wealth is clearly a key indicator for sustainable development. It captures an important part of the total national wealth, and furthermore gives signals of which parts of the economic wealth contribute the most to the national wealth. Usually, human capital turns out to be dominating, see e.g. World Bank (2005), while we could legitimately ask whether some of this belongs to the category of social capital. Thus, the World Bank estimates that approximately half of the residual in the decomposition of the national income, can be attributed to institutions, which clearly is part of social capital (World Bank, 2005). This implies that management of these resources are particularly important in securing sustainable development, and hence should be covered in more detail by including further indicators on these types of resource.

3.4.2 Additional indicators to EW

152. Because aggregate real per capita economic wealth suffers from the above shortcomings, it must be complemented with other indicators in a complete set of sustainable

¹⁵ In practice it turns out that people hold widely differing views as to what are reasonable price and production paths. Aslaksen et al., (1990) for instance, estimated the value of the oil wealth for Norway on the basis of official government price projections published in various contexts. They found that the year-on-year changes in the oil wealth essentially were due to changes in price expectations. For several years the changes were of a scale that exceeded that year's GDP! In other words, the uncertainty as to future oil prices is so great that adjusting GDP for depletion of the resource becomes virtually irrelevant.

development indicators. The first obvious extension is to complement EW with indicators of the wealth associated with each of the four main categories of capital; that is, to compile separate measures of produced capital, human capital, natural capital and social capital. It should be noted that while monetary measures of stocks of produced, human and natural capital are all, to varying degrees, empirically feasible today, such a measure seems not to be feasible for social capital. So, in practical terms, the set of five monetary indicators is really a set of four plus one place-holder for social capital. Extending the indicator set to include separate measures for each of the main capital categories takes care of the concern about the non-substitutability of capital stocks in the limit.

153. The next extension of the indicator set is necessary to take care of the fact that some capital assets are “critical” to development and, therefore, cannot even be substituted at the margin.

154. The main category in which critical assets are found is natural capital, as it is here where the assets that are essential for basic life support reside. Although there remain scientific debates as to just which environmental assets are critical and which are not, there is reasonable consensus that the following are all very important if not essential:

- a reasonably stable and predictable climate
- air this is safe to breath
- high-quality water in sufficient quantities
- areas of intact natural landscapes
- a diversity of plant and animal life
- productive soil

155. The sustainable development indicator set should, then, be extended to include an indicator in each of the above six areas, bringing the total number of indicators to this point to 11. These indicators of critical natural capital will be measured in appropriate physical units, since valuation of critical (non-substitutable) assets is not appropriate.

156. The final extension to the indicator set is that which is necessary to account for the fact that some capital assets contribute to social welfare outside of the market place. While this is not a concern for produced capital, it is for human, natural and social capital.

157. Natural capital contributes to welfare outside the market mainly when humans experience nature directly (e.g., when camping) or when they derive pleasure from the knowledge that nature continues to exist. In principle, the social welfare associated with this use of natural capital can be valued in monetary terms. To the extent that this is the case, a monetary indicator of the non-market value of natural capital would be worthwhile. In practice, however, the scope for actually estimating such values is limited and any such monetary indicator would likely underestimate the true social welfare of non-market enjoyment of nature. Physical indicators are therefore called for in practice.

158. Since many of the same features of the environment that are critical to development are also those from which humans would derive non-market welfare, it is proposed that the same set of physical indicators listed above serve also as the indicators of non-market natural capital. The list therefore remains at 11 indicators.

159. Human capital also contributes to welfare outside the market place. In the same way that education and good health make us better workers, they also allow us to be better parents,

to be finer members of society, to better enjoy the arts and to find deeper personal fulfilment. Again, though in principle it would be possible to estimate the non-market social welfare associated with human capital in monetary terms, in practice the scope for doing so is limited. Once again, then, physical indicators are recommended. In this case, an indicator is needed for each of the two core dimensions of human capital: educational achievement and health status. These two bring the total number of indicators to 13.

160. The last item that requires discussion is the contribution of social capital to non-market welfare. As with human and natural capital, it seems reasonable to suggest that social capital makes a contribution to non-market welfare. And, as with its contribution to market welfare, the scope for valuing social capital's contribution to non-market welfare appears exceedingly small at this time. Unlike for human and natural capital, though, there are no obvious physical indicators of social capital that might be postulated as representative of its contribution to non-market welfare. In particular among economists social capital is viewed as an ill defined concept. How do you invest in social capital? How do you conceive it as a stock? These are some of the questions that are posed as argument against including social capital among the capital types constituting national wealth (see Dasgupta, 2001). Dasgupta in particular seems to favour that the concept of institutions, i.e. rules governing how capital is moved and allocated, is a better description of what others prefer to denote as social capital.

161. Although the measurement of social capital is difficult, measurement instruments are being intensively developed (Czesany, 2007). For instance, based on experience with a multitude of social capital indicators in case studies, Grootaert and van Bastelaer (2002: 31-32) suggest that the focus should be on three types of proxy indicators of social capital: membership in local associations and networks, indicators of trust and adherence to norms, and an indicator of collective action:

- **Membership in local associations and networks.** Using membership in local associations as an indicator of structural social capital consists of counting the associations and their members and measuring various aspects of membership (such as internal heterogeneity) and institutional functioning (such as the extent of democratic decision making). Which associations to include in the indicators are culture-specific: agrarian syndicates could be relevant in one country, rotating credit and savings associations in another, parent-teacher associations in yet another. In the case of networks, which are less formal, the key information is the scope of the network and the internal diversity of membership;
- **Indicators of trust and adherence to norms.** Measuring trust and adherence to norms (cognitive social capital) requires asking respondents about their expectations and experiences with behaviour requiring trust. Key questions relate to the extent to which households received or would receive assistance from members of their community or network in case of various emergencies (loss of income, illness);
- **Collective action.** The provision of many services requires a collective action by a group of individuals. The extent to which this collective action occurs can be measured and is an indicator of underlying social cohesion (at least to the extent that the cooperation is not imposed by an external force, such as the government).

162. As proxies, these three types of indicators measure social capital from different vantage points. Membership in local associations and networks is clearly an input indicator since the associations and networks are the vehicles through which social capital can be acquired. This indicator resembles perhaps most closely the use of years of schooling as a

proxy for human capital. Trust can be seen as an input or an output indicator or even as a direct measure of social capital depending on one's conceptual approach. Collective action is clearly an output indicator.

163. However it is termed, OECD reviewed evidence suggesting that a close integration in society within a network of trust and cooperation is important for well-being, health and job search activities. Still, it is impractical at this stage to try to quantify these linkages in the form of true accounting prices for social capital. Because of the difficulty of pinning down exactly what constitutes social capital the concept of social capital remains too ill-defined at the moment for practical indicator suggestions to be made.

164. The final list of sustainable development indicators remains at 13, see Table 3.2:

Table 3.2 Suggested indicators based on the capital approach.

1. real per capita economic wealth
2. real per capita produced capital
3. real per capita human capital
4. real per capita natural capital
5. real per capita social capital (place holder)
6. a physical indicator of climate
7. a physical indicator of air quality
8. a physical indicator of water quantity/quality
9. a physical indicator of ecological integrity
10. a physical indicator of biological integrity
11. a physical indicator of soil productivity
12. a physical indicator of educational attainment
13. a physical indicator of health status.

3.5 Policy implications of the capital approach

165. The capital approach to indicators for sustainable development leads generally to policy implications of two sorts: policies to optimize the social welfare associated with a given stock of capital assets; and policies to limit or reverse the depletion/degradation/depreciation of capital stocks through investments of savings. These general implications translate into myriad specific implications for each of the different capital types.

166. Regarding the first type of recommendations (get more social welfare for a given capital stock) they may for instance be based on international comparisons – a sort of benchmarking among countries with enough similarities to make comparisons meaningful. If country A get more welfare out of a given amount of natural, human and social capital than country B, it may be worthwhile for country B to visit country A to get ideas of how the resource base is utilised in this country.

167. The second type of recommendation is a question of managing the total national wealth in a best possible manner. This is not primarily about maximizing the size of each of the wealth components, but more about high-lightening the opportunity costs related to investment in and use of different types of capital. The capital approach thus invites to a

debate on the values of different types of capital and thus seeks to balance concern for economic development with a preservation of other stocks giving rise to welfare in society.

168. An additional consequence for the capital approach is its focus on the long-term. Indicating the development of capital stocks necessarily points to long-term consequences of today's actions; do immediate benefits come at the expense of a long-term run down of our resource base? Or could we, by sacrificing small amounts of current consumption today, secure a higher probability for increased welfare tomorrow?

169. A separate and final point is the 'scalability' of the capital approach, i.e. possibility of defining regional/global as well as local wealth components (capital stocks), which will give interesting signals to policies at the various levels, e.g. with regard to management of local wealth. Making local communities aware of their local wealth (size and composition) highlights the comparative advantages of the community and thus direct their management skills towards preserving the most important assets for the community, being it natural resources, human capital or social capital. Again, inter-comparison between different but similar communities should make best practice guidance more available.

4 A capital-based measurement framework

170. Indicators based on the capital approach will of course have to be based on a set of data or *measurement frameworks*. A measurement framework in this context is a practical set of data and organizational rules that translate a conceptual framework (e.g., the capital approach) into policy relevant information in the form of a sustainable development indicator set. The national account (NA) is an example of a measurement framework supporting the widespread short-term economic indicator Gross Domestic Product (GDP). In this chapter we outline a measurement framework for the expanded notion of capital that has been presented in the previous chapter.

171. The most obvious candidate for a measurement framework is a set of national accounts suitably expanded to consider environmental and social elements relevant for the sustainability of longer term developments in addition to economic forces driving development, notably savings and investments. The extension of the Standards for National Accounts (SNA) to cover natural resources is done in the Systems of Environmental and Economic Accounting (SEEA) (UN et al., 2003). A similar recommendation for social issues, including human capital does not exist, but part of human capital can be estimated with data from the national accounts, see Greaker (2007).

4.1 A framework for natural capital

172. The Systems of Environmental and Economic Accounting (SEEA) comprises four areas or categories of accounts:

- Flow accounts for pollution, energy and materials (Chapters 3 and 4 of the SEEA). These accounts provide information in physical terms at the industry level about the use of energy and materials as inputs to production and the generation of pollutants and solid waste.
- Environmental protection and resource management expenditure accounts (Chapters 5 and 6). These accounts identify expenditures incurred by industry, government and households to protect the environment or to manage natural resources. They take those elements of the existing SNA which are relevant to the good management of the environment and show how the environment-related transactions can be made more explicit.
- Natural resource asset accounts (Chapters 7 and 8). These accounts, again kept in physical terms, record stocks and changes in stocks of natural resources such as land, fish, forest, water and minerals.
- Finally, valuation of non-market flow and environmentally adjusted aggregates are covered in Chapters 9 and 10 of the SEEA. This component presents non-market valuation techniques and their applicability in answering specific policy questions. It discusses the calculation of several macroeconomic aggregates adjusted for depletion and degradation costs and their advantages and disadvantages. It also considers adjustments concerning the so-called defensive expenditures. When these adjustments are applied to GDP, one ends up with an environmentally adjusted domestic product – EDP – or more commonly referred to as green GDP.

There is a challenge in making valuation of non-marketed goods and services as well as classifying certain activities as defensive expenditures that a fair amount of subjective

judgements are needed. It is of paramount importance for the acceptability of a sustainable development indicator set that the indicators should be transparent, in order to avoid discussions about more or less controversial methodological choice which takes focus away from the issues meant to be highlighted by the indicators. Better then to identify indicators based more directly on observable data that can shed light on the non-valued part of the natural capital.

4.2 A framework for human capital¹⁶

173. Human capital has been given many definitions, and a good account of some of those is given in Stroombergen, Rose and Nana (2002). One example is the definition of OECD (2001): *Human capital is the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being*. This definition points to the crucial fact that human capital is embodied in humans. Human capital is therefore not, unlike physical capital, traded separately in markets.

174. In the literature, human capital is decomposed into *raw labour, education and skills*. Moreover, in the same literature the notion of human capital is mostly only connected to *education and skills*. Furthermore, the value of the human capital component has been calculated for at least three different purposes other than evaluating sustainable development (see e.g. Stroombergen, Rose and Nana, 2002):

- To evaluate education policy
- To evaluate what determines employment
- To understand economic growth

175. Many methods for estimating human capital have been developed; again see Stroombergen, Rose and Nana (2002) for an excellent survey. Basically, the methods for estimating human capital can be categorized in following way:

1. The cost based method that estimates human capital from the input side.
2. The revenue generating method that estimates human capital from the output side.
3. The current stock characteristics method.

176. When estimating human capital from the *input side*, all expenses that contribute to human capital formation are summed. The most obvious expenses are public and private direct expenses to education and foregone income while under education. But also other expenses should ideally be included, for instance expenses to on-job training and employer financed outside job courses. The measure should also include depreciation, since people leave the workforce, they stay unemployed for longer periods of time, or they start in a new trade, all which implies a reduction of the human capital component.

177. When estimating human capital from the *output side*, it is from an economic point of view the expected wage obtained in the future labour market that matters. This method is much used in the growth literature, and is elaborated further below. Two points are worth mentioning here: Firstly, the method doesn't separate well between social capital and human capital. To the extent that the level of social capital is high in a country, it would presumably

¹⁶ This section draws heavily on Grecker (2007).

increase the wages obtained in the labour market in general. Secondly, it does not measure the benefits from human capital that is not paid for in markets. Clearly, a higher education can yield benefits that are intangible, and therefore, resistant to measurement.

178. Finally, one could also construct a proxy measure for the current state of the human capital component. Such a measure would among others include average years of schooling in the population, the extent of literacy, unemployment rates and the health status of the population. Clearly, it is difficult to translate such a characterization of the stock of human capital into a money measure.

179. In an ideal world the three measures should yield the same result. That is, total investments in human capital should equal the discounted sum of expected returns, which again should equal the estimated value based on current characteristics. Clearly, there are many reasons why this is not the case, of which one is that many benefits from education are not valued in markets. The strand of literature in which sustainable development has been the point of departure has seemingly mostly used the input based approach, while as mentioned; the economic growth literature has used the output based approach (sometimes combined with the input based approach).

4.2.1 Approaches in the growth literature

180. While the sustainability literature mostly has tracked changes in the value of human capital from the input side, that is expenditures on education, wages to teachers etc., the growth literature has also measured human capital from the output side (Greaker, 2007). In the book by Becker (1975, 1993) he calculates rates of return to education by looking at wage differentials between workers with different levels of education. Jorgenson and Fraumeni take Becker's approach a step further, and in a series of contributions they both calculate the human capital component of the US and explain their method (see Jorgenson and Fraumeni 1989 and 1992). On the other hand, as far as we know, the approach followed by Jorgenson and Fraumeni has not been applied by the literature on indicators for sustainable development. Very broadly their approach follows the following steps:

1. Construct a database containing the economic value of labour market activities for various categories of people. The database should at least include wage rates and labour market participation cross-classified with sex, education attainment and age. The database should ideally comprise all persons aged 16 to 75.
2. Program an algorithm calculating the lifetime income for each person in the database. That is, assume that each person in the future will obtain the same wage rate and have the same labour market participation rates as elder persons with the same characteristics currently living. The sum of the lifetime incomes will be equal to the total human capital stock.
3. Update the database periodically, ideally each year; such that all changes in human capital due to changes in education attainment, labour market participation, demographic development etc. can be traced.

181. Note that Jorgenson and Fraumeni also included the value of leisure (by the after tax marginal wage rate of the person in question). The method of Jorgenson and Fraumeni has been applied to other countries than the US, see for instance an application to Australia by Hui Wei (2004) and to Norway by Ervik, Holmøy and Hægeland (2003).

182. Much of the required information can be found in the national accounts together with underlying work force accounts etc. That is, most of the relevant data can be expected to be already available to a large degree.

4.3 A framework for social capital

183. Social capital is the least developed category of capital in the total national wealth (Dasgupta, 2003). The many different definitions given nevertheless point to the existence of social networks as a source of welfare. Social capital is then viewed as the “glue” generating excess cooperation (Paldam, 2000). Still, the delimitation between human capital and social capital tends to be fuzzy. Basically, and this may be the strong point of introducing social capital on par with other capital types, it points to the societal beneficial externalities that are created when there are networks, and some say trust, among members of the society.

184. In the growth and development literature, it is argued that institutions and how they work – governance – is important for nations longer term development. In countries, notably developing countries, with a lack of development, one cause is often lack of good governance. The World Bank thus discusses social (institutional) capital, see for instance World Bank (2005).

185. Another approach to the issue of social sustainability is to look at social protection systems and how well they function, see D’Ercole and Salvini (2003). A third example come from Spellerberg (2001). In this work social capital is related to three interdependent components:

- Behaviour (what people do)
- Attitudes and values (what people believe)
- Population groups (what people are)

186. Within each of these groups Spellerberg suggests a number of indicators.

187. Given the many approaches, it comes as no surprise that it difficult even to envisage how (changes in) social capital should be measured. In any case, it is important to underline that in search of good indicators reflecting the status of social capital, one should focus on social factors of importance to the longer term development, and not rely on social conditions and statistics important for shorter term social problems.

188. Here, the point is to note the type of data sources needed in order to construct these types of indicators. For instance, behavioural indicators will typically draw heavily on time use surveys. Attitude indicators will likely mostly come from social surveys and surveys specifically asking for attitudes, like political polling etc. Finally, population indicators can most readily be constructed from population censuses. Thus, a wide variety of data sources is needed to capture even the rudimentary characteristics of social capital.

4.4 Comparison of the capital approach and other approaches

189. Comparing the suggested indicator set based on the capital approach (Table 3.2) with indicators often used in existing approaches (Table 2.3), we find some commonalities and quite a few differences.

Table 4.1 below summarises this by cross referencing the two tables.

Table 4.1 A comparison between indicators commonly found in existing indicator sets and indicators based on the capital approach.

Broad indicators commonly found in existing approaches	Covered by indicators based on the capital approach
1) GDP per capita	
2) Emissions of greenhouse gases	6. A physical indicator of climate
3) Education attainment	12. A physical indicator of educational attainment
4) Municipal waste collected and its disposal	
5) Official Development Assistance	
6) Unemployment rate	
7) Life expectancy	13. A physical indicator of health status.
8) Biodiversity and number of protected species (birds, trees)	10. A physical indicator of biological integrity
9) Share of energy from renewable sources	
10) General government gross net debt	
11) Research & Development expenditure	
12) Risk of poverty	
13) Air pollution	7. A physical indicator of air quality
14) Emission of ozone precursors	7. A physical indicator of air quality
15) Employment rate	
16) Organic farming	
17) Mortality due to selected key illnesses	13. A physical indicator of health status.
18) Energy consumption by sectors	
19) Energy use and intensity	
20) Water quality	8. A physical indicator of water quantity/quality
21) Investment share of GDP	
22) Freight transport by mode	
23) Area of protected land	9. A physical indicator of ecological integrity
24) Fishing stock within safe biological limits	10. A physical indicator of biological integrity
25) Intensity of water use	8. A physical indicator of water quantity/quality

190. From the table it is apparent that none of the monetarised indicators in the set based on the capital approach (i.e. the real per capita produced, natural, human and social capital), are among the commonly found indicators in existing sets. Also physical indicators for soil productivity are absent. On the other hand, what are ‘missing’ in the indicator set based on the capital approach compared to indicators commonly found in existing sets are indicators

related to: GDP, waste, official development aid (ODA), unemployment, public finances, energy use, organic farming, spending on research and investments and transport.

191. Some of these indicators are clearly very difficult to relate to sustainable development. It is for instance difficult to see how GDP-related indicators can say very much about the long-term potential for further development. Thus, an unsustainable extraction or harvest of natural resources will likely increase the instantaneous GDP level, but nevertheless undermine long-term development. Others are at least partially captured by the capital indicators. Thus, research and development can be seen as investments in human capital, investments enhances produced and/or financial capital, unemployment affects both human and social capital, and energy is sometimes covered by natural capital. What is clearly of relevance for global sustainable development and covered in the indicator set based on the capital approach is what nations are doing for the development in other nations, i.e. ODA.

4.5 A proposed small set of indicators (that might become the core for international comparisons)

192. Sustainable development requires that none of the main capital components, notably natural capital or natural resources, is reduced beyond critical or irreversible levels; -- Thus one needs estimates not only for total economic wealth (EW) per capita in real value terms, but also for the individual components of the capital stock -- including physical sustainability indicators for the part of total national wealth (TNW) not captured by EW.

193. This then defines the *domains* of the indicators and for sustainable development policies in general: One the one hand the four types of capital (produced, natural, human and social), and on the other what is having impacts on measured economic activity (captured by EW) and what has value in terms of welfare, but are not possible to ascribe a monetary value.

194. By focusing on national wealth, the capital approach indicators as laid out in Table 3.2 tend to neglect a nations impact on the global wealth. This point was brought forward by comparing the indicator set based on the capital approach with common indicators found in existing indicator sets, see

Table 4.1. An indicator reflecting national impacts on global wealth in the form of long-term development in developing/poor countries, could therefore usefully supplement the capital approach indicator set. Even though e.g. ODA viewed in isolation reduces that country's national wealth in the short-term, ODA could easily be seen as contributing to national wealth in developing countries and thus wealth globally. Thus it is consistent with analytical model behind the capital approach which looks at resources bases, both nationally and globally, and how the assets have to be sustained over time.

195. The core set of sustainable development indicators for national policy making could therefore be:

Table 4.2 A proposed small set of sustainable development indicators

1.	Real per capita economic wealth
2.	Real per capita produced capital
3.	Real per capita human capital
4.	Real per capita natural capital
5.	Real per capita social capital (place holder)
6.	A physical indicator of climate
7.	A physical indicator of air quality
8.	A physical indicator of water quantity/quality
9.	A physical indicator of ecological integrity
10.	A physical indicator of biological integrity
11.	A physical indicator of soil productivity
12.	A physical indicator of educational attainment
13.	A physical indicator of health status.
14.	An indicator reflecting A nations impact on the global wealth

196. This is a small set of national sustainable development indicators in monetary and non-monetary terms for national awareness and policy making. For more detailed analysis of key sustainable development policies, more detailed statistics and indicators could easily be foreseen.

4.6 Requirements to sustainable development indicators (SDI)

197. The indicator set in is not spelled out in complete detail, e.g. it remains to actually select some of the concrete indicators. This final selection should fulfil some basic requirements in order for the complete indicator set to be a useful communication tool:

- The indicator set should be *transparent*. This is best secured if the individual indicator is based directly on observable data. In particular one should avoid using indexes when the weighting scheme is more or less arbitrary as this will lead to too much focus on methodological issues and take the focus away from the real issue.
- The indicators should preferably reflect *changes* in wealth components.
- Finally, the indicator set should be *internationally comparable* in order to allow benchmarking of nations with respect to sustainable development.

198. Fulfilling all of these requirements is obviously difficult; a compromise between ideal targets and achievable goals will have to be reached. Thus, the development of sets of

sustainable development indicators should be an evolutionary exercise, progressing in a systematic manner with frequent evaluations taking place.

199. Both the starting point and the process will over time make clear where data are lacking and perhaps also what kind of data are needed. Thus, the development of sustainable development indicators will not only guide policy making, but will also indicate where further development of data, statistics, accounts and analyses are required.

5 Conclusions

5.1 Describing the capital approach

200. Sustainable development is a popular concept, but difficult to measure. Over some quite considerable time now, people spanning from researchers in academic settings to official statisticians in national as well as international organisations have come up with suggestions for how to achieve this. The great proliferation of suggestions and general lack of coherence and convergence over time, cf. Chapter 2, testify to the challenge of the tasks.

201. The approaches taken spans from the construction of comprehensive accounting schemes along the lines of SEEA, to the promotion of single all encompassing indices popularly denoted “green GDP”, “total welfare index” or something similar. Emphasis is most often placed on correcting traditional economic indices like GDP per capita for depletion and deterioration of natural resources, although sometimes other social dimensions are also included. Finally, there have been several attempts at constructing sustainable development indicators spanning all the dimensions usually associated with the concept; economic, environmental (or natural resources), social and institutional. These indicator families do not show consistent evidence of agreement of approach or convergence in content, however it is possible to identify a small subset of indicators that are found in most sets.

202. One of the reasons for the variety of approaches is the many possible interpretations that can be given to the term sustainable development itself, as well as the different weightings that one could give to the different facets of the concept.

5.1.1 The capital approach

203. This report has strived for establishing a conceptual framework for the construction of sustainable development indicators that, over time, can allow a more congruent, harmonious and convergent development to take place internationally.

204. A hallmark of the capital approach is its insistence on the importance of the inputs in welfare generating activities; what is termed total nation wealth. This is in part a choice of convenience, since the social welfare itself is more difficult to observe and measure than its constituents. It is also, however, a reflection of the choice of targeting and focusing upon the long-term structural issues confronting our societies, a choice that is partly motivated by the “short-term-ism” that tends to dominate day-to-day policy and hence the media. Besides, it is undoubtedly so that without proper management of the total resource base of our societies, including economic, environmental as well as societal resources, we will have scant possibilities of sustaining the mainly positive development we have had over the last century or so.

205. Finally, by focusing on the resource base of our societies and its management, a framework is created that is a natural extension of the well-established framework for measuring economic activity; namely the national accounts (in particular the capital accounts). Traditional economic development theories have always focused on capital, investments and savings. Thus, extending the focus of the national accountants to non-marketed resources and new categories of capital, a well founded basis for understanding and

measuring sustainable development is given. The extension is natural also from a theoretical point of view.

206. If nations and regions (like the EU), and even local communities, put in an effort in establishing sustainable development indicator sets along the lines outlined in this report, there would be the following advantages:

- Countries could compare and perhaps compete in developing sound management systems for their total national wealth (including in addition to financial and real capital, also human and social capital and natural resources). Thereby best practices could be learned and a stronger focus on long-term structural development be secured.
- A higher recognition of nation's comparative advantages could be developed, thus securing a more efficient management and use of the total resource base globally.
- The long-term structural development of societies can be highlighted, whereby negative and threatening but slow developments can be observed and hopefully corrected.

5.2 A brief set of recommendations to countries

207. A national set of indicator for sustainable development should be created based on the capital approach for each country, cf. Table 4.2. This implies, *inter alia*, that the indicators should be selected so as to reflect both the quantity and the quality of the different capital assets constituting the total national wealth:

- Real and financial capital
- Natural capital (including environmental services)
- Human capital
- Social capital

208. An indicator of economic wealth (EW) and its decomposition will provide key information for sustainable development in terms of economic productivity effects of the various components of the resource base. While data on produced capital can be taken from the national accounts, supplementary data are needed when it comes to estimates of natural, human and social capital. SEEA (2003) provides guidance on data needed in estimating the natural capital component, and Greaker (2007) has elaborated on a possible scheme for estimating part of the human capital. This, and the issue of understanding the residual between bottom-up calculation of the value of the different assets and the total economic wealth (EW) remain challenging and require further work.

209. (other recommendations?)...

5.3 Challenges related to set up such a system

5.3.1 Data collection challenges

210. As mentioned, estimates of the various capital components require detailed data on quantities, for instance in the form of physical natural resource accounts, education, health and labour statistics, etc. What is available and what is lacking will vary by country, but will be made clearer by actual calculation of the proposed indicators.

5.3.2 Methodological challenges (e.g., valuation)

211. In addition to information in physical terms, valuations of the assets are needed. Sometimes market prices are acceptable estimates of the relevant accounting prices, in other instances specific analyses will have to be carried out. Priorities in this work will again vary from country to country.

5.3.3 Conceptual challenges

212. We have noted earlier in this report that the understanding and definition of social capital is less precise and mature than our understanding and conceptualisation of the other broad types of assets. There are clearly challenges related to work out more specific indicators and valuation schemes for social capital.

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Appendix 1 – Terms of reference for a working group on statistics for sustainable development (WGSSD)

INTRODUCTION

1. Sustainable development indicators are used by national governments and international agencies for monitoring progress towards goals set by national governments and comparing performance among countries. The working group should identify good concepts and practices in order to assist national governments and international organizations in the design of sustainable development indicator sets and in the development of official statistics in the area. However, it should be clear that the objective is not to develop international recommendations on a particular set of sustainable development indicators to be used at the national level. Effort should be devoted to establishing a common understanding of the “object” of sustainability (that which is to be sustained) and to establishing core principles of the measurement of sustainability.

PROPOSAL

2. The working group should:

- i) articulate a broad conceptual framework for sustainable development measurement. While the starting point of this work should be the concept of capital, the group should also consider other approaches to the extent the capital approach is found insufficient from a conceptual standpoint;
- ii) identify the broad domains that good indicator sets should span;
- iii) develop a menu of good sustainable development indicators in order to help governments and international organizations when they are designing indicator sets;
- iv) identify a small set of indicators from the menu that might become the core for international comparisons;
- v) identify basic data systems necessary for a small set of indicators and identify their possible sources (existing or new statistical surveys, administrative records, information derived from environmental monitoring systems);
- vi) discuss the relationship between integrated environmental and economic accounts and sustainable development indicators.

3. The working group will be a joint working group of the OECD and the UNECE Conference of European Statisticians (CES) chaired by Robert Smith from Statistics Canada. The OECD Statistics Directorate will provide the working group with a secretariat; some secretarial support will also be provided by UNECE and Eurostat. The working group will submit a more detailed project (with milestones) to the Bureau of the Conference of European Statisticians in February 2006. The working group should, at the conclusion of its work,

report back to the Conference of European Statisticians and the OECD Annual Meeting of Sustainable Development Experts.

TIMETABLE

4. The working group should endeavour to have an interim set of recommendations by spring of 2007, in time for discussion as appropriate at the June 2007 meeting of the CES. A final set of recommendations should be prepared by the end of 2007.

Appendix 2 – Terms of reference for the Steering Committee

ECE/CES/BUR/2006/17

**STATISTICAL COMMISSION and
ECONOMIC COMMISSION FOR EUROPE**

CONFERENCE OF EUROPEAN STATISTICIANS

Third meeting of the 2005/2006 Bureau
Geneva, 20-21 February 2006

STEERING COMMITTEE FOR THE WORKING GROUP ON STATISTICS FOR SUSTAINABLE DEVELOPMENT (WGSSD)

BACKGROUND

1. At the second meeting of the 2005/2006 CES Bureau, 24-25 October 2005, Washington D.C., the creation of a joint OECD/UNECE Working group on Statistics for Sustainable Development (WGSSD) was approved (ECE/CES/BUR/2005/12/Rev). To facilitate the operations of the WGSSD, an informal meeting of experts that took place in December 2005 in New York recommended that a Steering Committee be created. The members of the Steering Committee will be identified from among those countries and institutions participating in the full working group.

OBJECTIVES OF THE STEERING COMMITTEE

2. The main objectives of the Steering Committee are: to assist the Chair in operational planning for the WGSSD (e.g. identifying meeting dates and locations; preparing meeting agendas); to propose a programme of work for the WGSSD for approval by the full group; to periodically review the programme of work and recommend changes as necessary for approval by the full group; to oversee and, as necessary, contribute to the programme of work to ensure that the group is progressing effectively toward its objectives; to ensure, to the best of its ability, that the WGSSD is able to garner sufficient support from countries and institutions to complete its mandate.

COMPOSITION OF THE STEERING COMMITTEE

3. The Steering Committee will include representatives from Canada, Germany, Norway, Sweden, Switzerland, UNECE, Eurostat, OECD, UN Statistics Division, UN Division for Sustainable Development and (possibly) World Bank.

MEETINGS OF THE STEERING COMMITTEE

4. The Steering Committee is expected to meet face-to-face two or three times per year during the WGSSD's mandate. Meetings will normally be held in Paris and occasionally in New York, Geneva or Ottawa. The first meeting will take place in Paris on 13 March 2006. Work between meetings will be carried out electronically.

OUTPUTS

5. The main outputs of the Steering Committee will be: a proposed programme of work and timetable for the WGSSD; coordination of the work of the WGSSD with the aim of ensuring that the group meets its objectives within the timeframe of its mandate.

TIME FRAME

6. The Steering Committee will be operational during the full two-year mandate of the WGSSD.

Appendix 3 – National wealth and the calculation of the human capital component