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STATISTICS FOR SUSTAINABLE DEVELOPMENT

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

Prepared by Knut Alfsen, Statistics Norway

Statistics for Sustainable Development

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“Many important social processes take a long time – sometimes an extremely long time – to unfold. This is a problematic fact for contemporary social science, particularly in areas of inquiry where individual strategic action has become the central vantage point for framing questions and answers about social life. Especially in economics and political science, the time horizons of most analysts have become increasingly restricted.

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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1 Executive summary

(to be written in the end. Below are only some indications of what could go into this)

1.1 Summary

1. Why indicators and why the need for a conceptual approach?
 - easily understood and communicated information about long term trends of relevance for policy making
 - harmonisation or synchronisation across nations desirable since many of the long term challenges are global in nature and require concerted action
 -

What is sustainable development

2. The World Commission on Environment and Development (WCED, also known as the Brundtland Commission) expressed that “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. (WCED, 1987, p. 43). This can be further defined and redefined in a number of ways. Basically we like to think of sustainable development as a development *path* where social welfare does not decline at any point. Social welfare or utility is, however, not a concept to be observed. Thus, it raises a measurement problem.

3. Welfare or utility may be seen as being produced in our societies by using resources from a resource base to provide goods and services. The total resource base of a nation is what we call national wealth¹, and the value of that wealth resides in its ability to provide welfare. Sustainability can best be achieved if we are able to preserve the national wealth over time. Of course, sustainability is not guaranteed even in this case, but the potential for securing a non-decreasing social welfare is secured by preserving or increasing the total national wealth. Oppositely, if the national wealth is deteriorating, sustainable development is highly unlikely in the longer run.

4. Indicators for sustainability should address important long term trends in the availability and use of the different types of capital which together constitute the national wealth.

Natural, economic, human and social capital.

5. In everyday life we may distinguish between four different types of capital: natural, economic, human and social capital. The natural capital consist of all types of natural and environmental resources including land. The economic capital is produced capital including urban land and financial resources. Human capital includes both human resources in the form of raw labour and know how, while social capital reflects the value of institutions, social organizations and networks.

6. In general there is some degree of substitution possibilities between different types of capital. Thus, if a decrease in one type of capital is counterbalanced by a corresponding increase in another type

¹ According to Marshal, as quoted by Amavilah (2005), wealth consists of (1) transferable and non-transferable material goods, both man-made and Nature-given, along with the structure of property rights to them, and (2) non-transferable internal goods (human capital goods like education, and social capital goods such as trust) as well as external goods that have significant side-effects such as climate (geography), institutions, and other quasi- and pure public goods (see Marshall, 1961, p. 55).

of capital, each type of capital need not be preserved over time for the national wealth to be preserved and the potential for development to be sustainable. This is typically what can take place with the extraction of non-renewable natural resources like minerals and petroleum.

7. On the other hand, there are clearly limitations to the degree of substitutability between different types of capital. This may especially be the case for certain environmental resources that may be termed critical. Thus, many critical ecosystem services depend on a minimum degree of biodiversity in the ecosystem. If this resource is depleted below a critical level, we would sometimes be hard pressed to find ways to substitute the lost services.

8. This points to the infeasibility of aggregating all types of national capital into a single indicator for national wealth. Instead we need an indicator *set* covering the different aspect of the national wealth (capital types) that are not substitutable. At the same time it has value to aggregate the components of national wealth as far as defensible, i.e. where it is possible to find a common denominator for the value of the different components, and where these are substitutable to a reasonable degree. Of course, these considerations will to some degree be based on subjective judgements. It is therefore not possible to find the 'right' indicators for sustainable development purely by analytical means. There will always be an element of common sense and practical utility in the selection of the indicators. For this reason, the proof of the pudding will be in the eating; i.e. the final judgement of functionality of a selected indicator set will be through its practical utility and power to inform policy.

1.2 Outline of the report

9. The next chapter (Chapter 2) provides some background for this report outlining why is it being written and who the intended audience is. Furthermore, we discuss some definitions of central concepts (e.g. what do we mean by sustainable development, weak and strong sustainability, etc.), and we argue for the need for a conceptual approach when we try to measure sustainable development.

10. Chapter 3 then goes on to give an overview of some of the existing frameworks to measuring sustainable development and extracts some commonalities among these.

11. Chapter 4 describes what has become known as 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 if the total resource base, or national wealth, is preserved over time.

12. Chapter 5 provides an outline of what kind of statistics and data systems are needed in order to support an indicator set based on the capital approach, i.e. a capital-based measurement framework.

13. Chapter 6 then compares some of the existing approaches with the capital approach and comes up with both a menu of good sustainable development indicators and a smaller set of indicators that may become a core set for international comparisons.

14. Chapter 7 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.

1.3 Acknowledgements

2 Introduction

2.1 Background for the working group and the report

2.1.1 Mandate of the working group

15. Sustainable development indicators (SDI) 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 on Statistics for Sustainable Development, henceforth WGSSD, was established by the Conference of European Statisticians (CES) in 2006 in order to, if possible, structure the work on indicators better than have been the case up till now. 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 official statistics in the area (see Appendix 2 – Mandate of the working group for the full mandate).

16. Furthermore, the mandate says that working group should:

- 1) 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;
- 2) identify the broad domains that good indicator sets should span;
- 3) develop a menu of good sustainable development indicators in order to help governments and international organizations when they are designing indicator sets;
- 4) identify a small set of indicators from the menu that might become the core set for international comparisons;
- 5) 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);
- 6) discuss the relationship between integrated environmental and economic accounts and sustainable development indicators.

17. Robert Smith from Statistics Canada was appointed chair of the working group. The OECD Statistics Directorate together with the government of Norway, UNECE and Eurostat has provided the working group with secretarial support. The working group reports back to the Conference of European Statisticians and the OECD Annual Meeting of Sustainable Development Experts.

2.1.2 Composition of the Working group

18. The group has been open to participants from all 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.

2.1.3 Organisation of the work

19. With such a large group, it was found useful to appoint a smaller steering committee 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 3. Members of the Steering Committee have been:

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

20. From February 2007, Knut H. Alfsen from Statistics Norway and with support from the Ministry of Finance of 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 ...

2.1.4 Intended audience of the report

21. A report on “statistics on sustainable development” can be targeted at several different audiences; from statisticians in need of detailed technical manuals to policy makers and the public at large in need of a better understanding of what sustainable development entails in terms of concrete politics and measurements. Although formally reporting to experts in the Conference of European Statisticians and the OECD Annual Meeting of Sustainable Development Experts, this report is clearly geared towards policy makers and the public at large with an emphasis on 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.

2.2 Definitions of some basic concepts

22. “Sustainable development” was popularised as a normative goal for long term policy by the World Commission on Environment and Development (WCED)² in their book “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”³. While imprecise, the definition agree with the intuition that, since the term sustainable means “ending”

² The commission is commonly referred to as the Brundtland Commission after the chairperson, then prime minister of Norway, Gro Harlem Brundtland.

³ A great number of alternative definitions of sustainable development exist. One of the more bizarre is given by the online encyclopedia Wikipedie (at www.wikipedia.com downloaded 5 March 2007) where it is stated that: “Sustainable development is a collection of methods to create and sustain development which seeks to relieve poverty, create equitable standards of living, satisfy the basic needs of all peoples, and establish sustainable political practices all while taking the steps necessary to avoid irreversible damages to natural capital in the long term in turn for short term benefits by reconciling development projects with the regenerative capacity of the natural environment.”

or "lasting", sustainable development is development that lasts. However, a crucial question is what we mean by the term "development". Thus, the problems with the concept of "sustainable development" are not with the word sustainable, but with the term "development" (cf. Pearce and Warford, 1993, p. 42).

2.2.1 What do we understand by "development"?

23. As mentioned, it seems reasonable to interpret sustainable development as developments that can continue "for ever" or at least until the end politically relevant time horizon, e.g. the next generation considered by long term policy. 24. In addition, the development in question should have a positive quality; to deserve the term sustainable, the situation should not deteriorate. However, whether a given development is good or bad may be more difficult to judge and agree on, 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 naturally emphasize the functioning of ecosystems and any development threatening their robustness will be termed negative. Economists on the other hand will likely measure development in terms of per capita economic resources, primarily income. 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 provides creation of knowledge, skills and capabilities allowing greater individual choice and freedom and should as such be an important part of a positive development. Finally, institutional arrangements and state of governance has important ramifications for individual freedom and choice, and should, according to some, be an essential part whereby the nature of development should be judged.

24. What this diversity of perspectives reflects is that we as 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 our welfare, the precise definition of what constitutes a positive development is much harder to pin down. That we, either as individuals or societies, cannot easily agree on the precise definition and content of a good life is perhaps not that surprising. However, despite our different perspectives, norms and viewpoints, it is fruitful to ask the question where the welfare comes from, and what drives the development?

25 One step in such an analysis is to recognize that our welfare can be considered as the outcome of our consumption, understood in a comprehensive manner. This consumption consists of consumption of both goods and services that are produced and marketed as well as goods and services that are gathered and experienced. The next step is to ask where these consumption goods and services are coming from – in other words what is the basis for our welfare.

26. Whether the goods and services we consume are produced by us or gathered from our surroundings, it is reasonable to view them as stemming from a *resource base*. That resource base is composed then of both produced resources or capital in the form of machineries, buildings and other types of infrastructure, of natural resources in the form of renewable and non-renewable material resources, and in the form of environmental resources 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 so called human capital is therefore also an important part of our resource base. Some will in addition point to the fact that 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. This part of the resource base is sometimes called social capital.

27. Whatever we understand by the term “development” it seems reasonable to say that a larger, or stronger, resource base allows us to potentially secure a better development. We may of course fail in utilising the resource base effectively and instead waste the resources, but without an 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, to which we will return to in Chapter 4.

2.2.2 What do we understand with sustainable development?

The object of sustainability is development over time in social welfare.

28. Sustainable development can be defined and redefined in a number of ways. It remains central, however, that sustainable development is about social welfare *over time*. Thus, the time dimension is crucial; sustainable development is a dynamic concept that 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) is not possible 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, others may not. Thus is it impossible to characterise a *situation* (a certain state in a point of time) as sustainable. This is not to say that the current situation – or intra-generational issues more broadly – is of little relevance for welfare and wellbeing. For instance the disparity between the rich and the poor in today's world is a problem. However, it is difficult to state that the current uneven distribution of resources is unsustainable as such. However, a further deterioration is likely to be an unsustainable development path, but other development paths are luckily possible. Indicators for sustainable development therefore consist of time series, showing a trend, a development, a path, that may be deemed to be sustainable or otherwise.

2.2.3 Use of ‘sustainability’ to signal an alternative policy focus (on the long term)

29. It is a matter of fact that relatively large resources in today's industrialised societies are used to analyse and, where possible, understand development in the short term trends. News in all media reports on day-to-day fluctuations in market conditions, and statistical offices publish and comments 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 signal when we talk about sustainable development is to redirect some of the attention to long term trends and developments of crucial importance when we are concerned with the long term development and viability of our societies.

2.3 On the need for a conceptual approach to measuring sustainable development

30. Agenda 21, the Rio Declaration on Environment and Development, were adopted by more than 178 Governments at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro 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.

31. Agenda 21 states in paragraph 40.4 that:

“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.”

32. Further on, it 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

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)

33. 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 will be given in Chapter 3 titled *Overview of existing frameworks to measuring sustainable development*. Here, we only note that the plethora of approaches and indicators produced has led to some frustration in certain quarters about the state of affairs and the lack of international progress in this field when it comes to convergence and harmonisation of approached. Hence, there has been a request for developing a conceptual approach to the topic of sustainable development indicators that could give direction to the work and provide a mean for greater harmonisation in the international effort in developing sustainable development indicators (SDIs). This forms the background and rationale for this report. In addition, the working group consider the works on indicators as a proper part of the official statistical work. The indicators should be constructed to be part of 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.:

- It should not be directed by political influence.

- It should have a theoretical underpinning.
- Consistency over time should be secured.
- It should be coherent across issues.

34. In addition, one should recognize that indicators are a special branch of official statistics. In particular, indicators should provide information that direct attention to potential problematic issues, more than providing complete data for analysis of the problems. Use of indicators is thus more a mode of communication than a provider of all that is known about an issue. 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 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 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. Large indicator sets are often incomprehensible, and thereby become irrelevant.
- The indicator set should be policy relevant, e.g. by providing guidance on what policies needs to be changed in order to secure a more sustainable development.

2.4 On the geographical scale for sustainable development indicators

35. Finally, 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. We can, in a deep sense, only develop together on this Earth. While partial improvements are possible in selected areas, in the long run everybody will have to be aboard the 'development ship' if the travel 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 support or detract 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.

3 Overview of existing frameworks to measuring sustainable development

- The chapter will draw heavily on reports from working sub-group 1 and the Eurostat project to be finalised this summer.
- The chapter will identify commonalities among existing national approaches, perhaps separated in two groups; one focused on purely 'policy driven frameworks' and the other focused on conceptually driven approaches (e.g., Norway, Canada).

4 The capital framework

- This chapter will build on contributions from working sub-group 2 on the capital approach.

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

36. Sustainable development implies non-declining 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 capital⁴. Production (and therefore consumption) can therefore be seen as a function of capital, so welfare is, indirectly, also a function of capital.

37. Seen from this perspective, sustainable development is closely linked to management of our resources. Maintenance of our national wealth is, however, only a necessary, but not a sufficient, condition for sustainable development. A stable or growing national wealth nevertheless suggests rather strongly that such a development may be taking place. Conversely, a negative development of national wealth suggests that sustainable development is threatened.

38. The concept of a nation's total resource or capital base is sometimes termed the *national wealth* of the nation. Care should be taken in using this concept, however, as it is sometimes also used for a monetary valuation of the productive assets in an economy. We will use the term *national wealth* in a broader, but also looser, sense, as a term designating the total resource base of a nation, including both tangible and non-tangible resources, and including all resources or types of capital giving rise to social welfare, or wellbeing in people.

39. Of course traditional types of capital like financial assets and physical or real (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. In addition less tangible types of capital must be included. 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 and governmental structures regulating our lives, and a myriad of different types of networks exists that links and regulates our interactions with others in ways that clearly enhances our welfare. This highly intangible type of infrastructure in civilized societies is sometimes termed *social capital*.

⁴ 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.

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

- Financial capital
- Real (produced) capital
- Natural and environmental capital
- Human capital
- Social capital.

41. What has been achieved by focusing on the resource base or national wealth when it comes to measure sustainable development? Four points seem worth putting forward:

42. First, while welfare or wellbeing is difficult – if not impossible – to measure with objectivity and precision, the natural 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 we will argue that it is a necessary condition.

43. Second, by framing the question of sustainability as a question of preserving our national wealth, we have created a limited ‘universe’ which we want to measure. Thereby, by following the capital approach we are able to assess whether our indicators for sustainable measurement leave out or not important and relevant issues. This would be very much more difficult without an all encompassing framework.

44. Third, by focusing on capital, a long term focus is more likely to be assured. This is because changes in capital stocks usually are slow. We are thus by this approach invited to consider long term structural changes in our societies. These are just the phenomena that may threaten the sustainability of the development.

45. Fourth and final, the capital approach is ‘scalable’ in the sense that it may work on several different geographical scales. It of course makes sense on a national scale to measure or indicate the status of the national wealth and follow this over time. However, also at the local scale can communities ask questions of how their ‘local wealth’ (i.e. resource base) is composed and whether or not it is managed in a way that may secure (partial) sustainable development at this scale. Having noted this scalability property, we will in the following focus on the national scale.

46. In the reasoning above we have translated and simplified the question of sustainability to a question of whether we manage our total resource base – national wealth – in a way that secures its maintenance over time. Thereby, the focus in the sustainability debate has been sharpened since the issue of sustainability has been put in concrete terms, i.e. a question whether our financial-, real-, natural-, environmental, social- and human capital increase or decline over time. Furthermore, if one wealth component, e.g. petroleum wealth, declines, is this being offset by growth of other components such as human capital? This last question touches on 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. We will return to this question after a brief description of the various types of capital that constitute national wealth.

4.2 Description of types of capital

4.2.1 Real (produced) capital

47. Real or produced capital refers to what economists most often understand by the term ‘capital’; that is produced machinery, buildings and infrastructure like roads, harbours and airports.

4.2.2 Financial capital

48. Financial capital is ‘money in the bank’, i.e. assets that can be converted into goods and services on short notice.

4.2.3 Natural and environmental capital

49. Natural capital refers to the earth's natural resources and the ecological systems that provide life-support services to society and all living things. This broad category of 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, hydro power and wind, to mention some. In addition it covers ecosystems and other systems able to provide various services to mankind. Examples are nature's absorptive capacity for waste products that otherwise would cause pollution damages and recreational services of many kinds.

4.2.4 Human capital

50. 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. It is “the stock of economically productive human capabilities” (Bahrman and Taubman in World Bank, 2006, p.89). OECD defines 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). 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 years. 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.

51. 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.

52. Human capital can be increased by investments in education, on-the-job training, health and nutrition.

4.2.5 Social capital

53. While human capital is conceived as individual, social capital refers to features of social organization 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 respectable, with the World Bank devoting a research programme to it and with its currency in Robert Putnam's 2000 book, *Bowling Alone*. The World Bank discusses economic and sociological aspects of social capital in Dasgupta and Serageldin (2000). There still seems to be significant conceptual vagueness associated with the concept of social capital (see separate Box for some attempts at definitions). In fact, there is probably broader agreement on what social capital does, than what it is.

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

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

4.3 Substitutability among types of capital. Weak versus strong sustainability

55. Given that the national wealth consists of the 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 national wealth, for instance measured in monetary terms⁵. If possible, this

⁵ Pearce and Atkinson (1993) introduced the concept of weak sustainability. Weak sustainability is a rule specifying that the overall capital stock 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 (unity in Cobb-Douglas production functions). Strong sustainability, on the other hand, assumes that substitution is limited, and that there

would be very convenient as it would allow us to generate an intuitively understandable indicator for sustainable development, on par with GDP as an indicator for economic development.

56. Unfortunately, there are several reasons why this is impossible. As we will argue 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 economic and scientific knowledge is limited, we should monitor the key capital components – and not only look at total aggregated national wealth and its long-term prospects.

4.3.1 Critical resources

57. We recognize 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 we receive from the environment, which may be considered as dividends of our environmental capital, without difficulty can be replaced by increased income, i.e. the dividend of other wealth components such as financial, real, natural resource or human capital. As an example one may consider a fundamental asset such as a reasonably stable climate. If the climate is destabilised by increased 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. Similarly, we know today that biological diversity is a fundamental condition for the maintenance of several central ecosystems' production of services for the benefit of all of us. Without a minimum of biological diversity, the services of central ecosystems may be significantly reduced with very adverse consequences for *inter alia* our food production.

4.3.2 Ethical considerations

58. 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.

59. We shall not pursue this matter any further here, but only note that the arguments listed above are all important reasons why it is not sufficient to ensure that *total* national wealth is being maintained. We argue that individual components will also have to be maintained at 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, in addition to assessing the development of total national wealth on a continuing basis.

4.3.3 System complexity

60. 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. Similarly, the multitude of man-made chemicals that escape into our environment is so large that we with our limited present knowledge are unable to predict all their

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).

effects, either on nature or on human beings more directly. An important aspect of conservation of biological diversity is the fact that many characteristics and potential values related to diversity still are little known. Nevertheless, as already noted, most of the services of the eco-system that we benefit from depend on the existence of a minimum of biological diversity in these systems. It will therefore be important to maintain ecosystems and biodiversity even if we today are unable to foresee how deficient ecosystem services will affect the economy or our national welfare.

61. These forms of incomplete knowledge provide an additional reason why key individual elements of the national wealth, and not only the total value, are important.

4.3.4 Practical problems in valuation

62. Even though crude estimates of national wealth is now produced as a standard procedure in most national statistical agencies in OECD countries, it is well known that there are many practical problems associated with this. In order to add the various components of national wealth, they have to be expressed in a common unit of measurement, usually in the form of money. Ideally, the value of a unit of national wealth should reflect how a unit of the relevant element could contribute to our welfare. However, it is difficult to estimate these so-called shadow prices, especially if the services are not traded in perfectly functioning markets. Again, certain individual environmental services provide good examples of services that are not traded in the markets. Thus, estimates of national wealth are usually incomplete. The complex nature of the systems referred to above makes it difficult to find correct prices of several wealth components.⁶

4.4 Proposed (aggregate) indicators that fall out of this approach

63. Accepting that it is not feasible to construct a single indicator for the total national wealth, it is at this point that a set of *indicators of sustainability* are useful: They may be selected in such a way that they in fact indicate what the expected welfare effects of key components of national wealth are. The strategy should therefore be to choose indicators that best reflect the value, defined as the welfare effects, of the various components of national wealth. Such a strategy is similar to the one Statistics Canada has described as "a capital approach", see Smith et al. (2001).

64. Despite the recognition that it is infeasible to find a single aggregated indicator of national wealth, many statistical bureaus together with international institutions like the World Bank, in fact calculate economic estimates of the 'national wealth' in monetary terms, see section 4.3.4 above. It is important here to separate these estimates from what we consider to be the national wealth. While we include the potential welfare effects of the total resource base as determining the national wealth, the narrower economic indicator, let us call it *economic wealth* (EW) for ease of reference, at best capture the marked based productivity effects of the various capital types. Nevertheless, while having obvious shortcomings, such an aggregated economic indicator clearly is of interest as one out of a set of sustainable development indicators.

65. The economic indicator is usually estimated on the basis of a procedure that is a variant of the following.

⁶ For interesting recent work on direct measures of the largest capital component, human capital, see Hui Wei: "Measuring the stock of Human capital for Australia" working paper No 2004/1, Australian Bureau of Statistics.

4.4.1 Economic wealth (EW)

66. Besides foreign claims, fixed or produced capital (machinery, buildings and infrastructure), human and social capital, economic wealth comprises natural and environmental capital. When estimating the economic wealth, the starting point is a decomposition of *net national income* (NNI) into contributions from these different types of capital. NNI for any given year can then be decomposed in the following way:

$$\begin{aligned} \text{NNI} = & + \text{i) Resource rents from renewable natural resources} \\ & + \text{ii) Resource rents from non-renewable natural resources} \\ & + \text{iii) Return on fixed capital} \\ & + \text{iv) Net income from financial wealth} \\ & + \text{v) Return on intangible (human, environmental and social) capital} \end{aligned}$$

67. The value of a capital asset is usually reckoned as the total discounted income accruing from it. With respect to natural resources this is usually referred to as a stream of *resource rents*. With point of departure in the national accounts, Eurostat (2001) defines resource rent in the following way:

$$\begin{aligned} \text{Resource rent} = & + \text{i) Basic value} \\ & + \text{ii) Taxes on products} \\ & - \text{iii) Subsidies on products} \\ & - \text{iv) Intermediate uses} \\ & - \text{v) Compensation of employees} \\ & - \text{vi) Return on fixed capital} \\ & - \text{vii) Capital consumption} \\ & - \text{viii) Non-industry specific taxes} \\ & + \text{ix) Non-industry specific subsidies} \end{aligned}$$

68. When calculating compensations to labour and capital (point v) and vi) above) the idea is to use wage rates and rates of return that reflects the *alternative value* of the workers and the capital employed to extract the resource. Hence, the resource rent can be interpreted as the extra income one obtains from having the right to utilize a (scarce) natural resource.

69. The value of fixed capital is usually taken from the national accounts. In order to calculate total return we 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, point iv) in the decomposition of NNI, is also given in the national accounts. Lastly, since NNI itself is reported in the national accounts, we can estimate the return on intangible capital residually (point v) in the NNI decomposition):

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

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

71. In order to calculate the economic wealth from the decomposition of NNI, 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.

72. 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. Still, 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:

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 intangible capital
+ iv) current value of fixed capital as given by NA
+ v) net financial wealth

73. If the extraction of non-renewable natural resources is constant or declining, and if the resource rent per unit of extracted resource is constant, and if reserves are not upgraded, point ii) above will decline as time passes. Thus, in order to keep EW constant or increasing, one or more of the other components will have to increase.

74. Clearly, economic wealth accounting as described above has many shortcomings. First of all, many renewable resources are usually not included; for instance ecosystem services, natural amenities etc. One major reason for this is that prices on the services that these renewable resources supplies do not exist. Consequently, our calculations can show that EW is increasing, while in reality, it is not. One example could be productivity improvements in forestry that increases the resource rents from the sector, but at the same time hampers the supply of non-timber values from forests to such a significant degree that EW actually decline.

75. Secondly, the estimate of EW is sensitive to assumptions about future prices. 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 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.

76. Lastly, the method by which intangible capital is calculated is clearly unsatisfactory. Since it is calculated residually, it is hard to understand what really drives the development in this factor, and how it is distributed among human, social and non-productive environmental capital.

4.4.2 Additional indicators to EW

77. Despite the obvious shortcomings, estimate of economic wealth as described above is clearly a key indicator in any indicator set for sustainable development. It captures an important part of the 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 (200x). This implies that management of these resources are particularly important in securing sustainability, and hence should be covered in more detail by including further indicators on this type of resource.

78. Other parts of the resource base are not captured by the economic wealth indicator. The notion that some capital stocks may be real, but essentially immeasurable (e.g., the atmosphere), means that we will have to proxy them with indirect measures. Thus, measuring air quality is, in some sense, a proxy for the state of the "atmosphere asset" that cannot be measured directly. Similar arguments can be put forward for including indicators covering the state of water resources (fresh as well as marine water) with respect to pollution.

79. A forest provides (goods and services):

- Timber
- Soil protection
- Water and air cleaning
- Recreational services
- Biodiversity/ecosystem support

80. A fresh water lake provides (goods and services):

- Drinking water
- Water for irrigation purposes
- Fish
-
- Recreational services

Material resources	Services/Non-material resources
- Non-renewable (Minerals, fossil gravel,...)	
- Renewable (fish, forest, other flo	

	Real and financial	Natural and environmental	Human capital	Social capital
Indicators				

4.5 Policy implications of the capital framework

- The capital approach 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
- Manage our total wealth!
- The capital approach highlights opportunity costs related to use of different types of capital. The approach invites to a debate on the values of different types of capital.
- A separate 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.

5 A capital-based measurement framework

- Give an outline of the *measurement frameworks*⁷ needed to support the indicators of the capital approach.
- Show the basic data systems necessary for producing a small set of indicators, and their possible sources (surveys, administrative registers, environmental monitoring systems)
- Discuss the relationship between integrated environmental and economic accounts (SEEA, NAMEA) and SDIs

6 Comparison of the capital approach and other approaches

- This chapter will compare the proposed SDIs derived from the capital approach with the common elements derived from existing indicator frameworks

6.1 Proposal for a menu of good sustainable development indicators

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

7 Conclusions

- Conclusions from the approach outlined, implementation issues and political implications.

⁷ A measurement framework is a practical set of data and organizational rules that translate a conceptual framework (e.g., capital) into policy relevant information. The national account is an example of a measurement framework. What we need to outline in this chapter is a measurement framework for the expanded notion of capital we will have presented in the previous chapter. The most obvious candidate for this is a set of national accounts suitably expanded to consider environmental and social issues. If there are other credible candidates for the measurement framework, then we should also discuss them.

- 7.1 A brief set of recommendations to countries**
- 7.2 Discussion of the challenges related to set up such a system***
 - 7.2.1 The challenge to keep the indicator set small and focused.**
 - 7.2.2 Data collection challenges**
 - 7.2.3 Methodological challenges (e.g., valuation)**
- 7.3 Future research agenda:**
 - 7.3.1 Means of communication**
 - 7.3.2 Methods of valuation**
 - 7.3.3 Defining and measuring social capital?**

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Appendix 1 - Country survey

Overview of approach and use of sustainable development indicators in member countries of the UNECE/OECD/Eurostat (~2 paragraphs per country)

Appendix 2 – Mandate of the working group

Appendix 3 – Mandate of the steering committee