MEASURING SUSTAINABLE DEVELOPMENT

Report of the Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development

UNITED NATIONS
New York and Geneva, 2OO8

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Note

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Many members of the Working Group and its Steering Committee have contributed papers for the discussions. The list of authors who contributed papers during the course of the work is presented in Annex 1.

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FOREWORD

Sustainable development is a popular and important concept, but one that is open to a variety of interpretations. Since the 1987 Brundtland report (World Commission on Environment and Development, 1987), many researchers in universities, environmental organizations, think-tanks, national governments and international agencies have offered proposals for measuring sustainable development. The wide variety of indicators in existing national and international policy-based sets testifies to the difficulty of the challenge.

The Joint UNECE/Eurostat/OECD Working Group on Statistics for Sustainable Development was established in 2005 to identify good concepts and practices to assist national governments and international organizations in the design of sustainable development indicator sets. The mandate of the group was to develop a broad conceptual framework for measuring sustainable development with the concept of capital at its centre, and to identify a small set of indicators that might become the core set for international comparisons.

The group had more than 90 members from 48 countries and international organizations who worked together to develop a framework towards measuring sustainable development. The group met five times during the period April 2006 to March 2008 and was lead by a Steering Committee which provided governance and continuity between the meetings.

This report is the result of the Group's efforts. It thoroughly explores the capital approach to measuring sustainable development and compares the indicators that fall out of this approach with those in existing sets. In this way, it draws the best from the conceptual work of researchers and the practical work of policy makers and statisticians. It is hoped that the report provides an impetus for further work on statistics for sustainable development in national statistical offices.

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EXECUTIVE SUMMARY

The present report is prepared by the Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development, which was mandated to propose a small set of sustainable development indicators that could be used for the purposes of international comparison. The results of the group's efforts are presented in detail in the main body of this report and in summary form below.

Although formally prepared for statistical offices in the UNECE, OECD and European Union member states, this report targets other audiences as well. It will benefit statisticians of any country in need of conceptual guidance on the measurement of sustainable development. At the same time, the general reader will find it helpful in understanding how sustainable development might be measured in concrete terms, as well as the strengths and weaknesses of different approaches. In this report, policy makers whose task is to ensure sustainable development will find in it an approach with which they may not be fully familiar – the approach based on capital. They will see this approach compared with existing national indicator sets derived from policy frameworks with which they will likely be more familiar. It is hoped that this comparison will help ignite a discussion about new ways of measuring sustainable development.

A. Mandate and functioning of the Working Group

The Working Group was established by the Bureau of the Conference of European Statisticians (CES) in 2005 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 Annex 3 for the full mandate). More particularly, the task of the Working Group was to:

(a) articulate a broad conceptual framework for sustainable development measurement with the concept of capital at its centre; consider other approaches to the extent the capital approach is found insufficient from a conceptual standpoint

(b) Identify the broad domains that good indicator sets should span;

(c) Develop a menu of good sustainable development indicators in order to help governments and international organizations when they are designing indicator sets;

(d) Identify a small set of indicators from the menu that might become the core set for international comparisons;

(e) 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); and

(f) Discuss the relationship between integrated environmental and economic accounts and sustainable development indicators.

The mandate was further clarified by the CES Bureau in October 2006. The Bureau agreed that:

(a) 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 was encouraged to go only as far as it can in a conceptually sound manner;

(b) 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.

The Working Group was open to participants from national statistical offices and other government bodies of all member states of the UNECE and OECD. A Steering Committee was established in order to guide its work. The full Working Group met five times over the course of its mandate.

B. Basic concepts

Development is thought of in this report as an increase in well-being across the members of a society between two points in time. Well-being is often used as a synonym for welfare, though the terms can have different formal meanings – particularly to economists. **Welfare** is formally defined as the benefit an individual derives from consuming goods and services over time. It is equal to the discounted present value of future utility. If consumption is measured for all members of a society, then this discounted present value is termed social welfare.

From the insights of economists, it can be shown that the way in which access to resources – another way of saying consumption opportunities – is distributed across individuals and their expectations of how they will benefit from that access are at the heart of welfare (Dasgupta, 2001; Samuelson 1961). This means that welfare is very closely related to what we think of as wealth, as wealth represents the totality of resources upon which we are able to draw to support ourselves over time. From this it is clear that welfare is a forward looking concept in which what counts is not how well off we are at a point in time, but our prospects for being well off in the future. In other words, welfare is an intertemporal concept.

As for well-being, there is no single definition and there remains considerable debate regarding its determinants. Some, as noted, use it synonymously with welfare. Others, including Dasgupta (2001), claim that well-being encompasses welfare but goes beyond it to include benefits derived from things other than consumption; for example, from the presence of fundamental human rights. While a formal distinction between welfare and well-being may be of importance in academic debate, it is not of great importance to the conclusions of this report. For this reason, and because it may be the more encompassing term, well-being is the term adopted here.

A central theme of this report is that the concept of well-being has much potential for measuring sustainable development *if* it is broadened beyond its traditional scope in economics.

Economists are interested mainly in the well-being derived from consumption as traditionally defined: the enjoyment of goods and services purchased in the market. But if it is to be useful for measuring sustainable development, well-being must be seen to be a function of consumption in the broadest sense possible. Consumption in this sense must include the enjoyment of any good or service that contributes to well-being, including things freely provided by nature like forest products and beautiful sunsets. It is possible even to think abstractly of the enjoyment of the benefits of human rights or psychic fitness as being forms of consumption.

It seems reasonable to interpret sustainable development as development that can continue "forever" or at least for a very long time; say, for several generations. Given the discussion above, this statement can be put more fundamentally: sustainable development is increasing well-being over a very long time. Yet more fundamentally: sustainable development is increasing consumption, following its broadest economic interpretation, over a very long time.

Upon these basic points, all members of the Working Group agreed. It must be acknowledged, though, that the group's views diverged importantly on other points. Differences arose, in particular, regarding the relationship between short- and long-term well-being and sustainable development. One view within the group, referred to as the integrated view, held that the goal of sustainable development is to ensure both the well-being of those currently living and the potential for the well-being of future generations. The second, labelled the future-oriented view, held that the concern of sustainable development is properly limited to just the latter; that is, sustainable development is about ensuring the potential for the well-being of future generations.

There was no attempt by the group to resolve this debate. Rather, the debate was acknowledged and the group moved on to explore the commonalities between existing national and international indicators of sustainable development, most of which are founded on the integrated view, and the indicators that fall out of the capital approach, which is aligned with the future-oriented view. The results of this exploration, outlined further below, show that there is much more in common between the approaches than imagined at the outset.

C. Commonalities in existing policy-based indicator sets

The focus of countries in establishing sustainable development indicator sets to date has been generally on meeting the information needs of a national sustainable development strategy. It is relatively rare that such policies have been based on an explicitly defined conceptual framework. They have often been, however, the result of rigorous consultation inside and outside of government to ensure that different perspectives on how sustainable development should be defined are taken into account.

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

In many cases the relationship between indicators and policy is very strong – with the policy framework in effect determining the indicators. While there may be concerns about having indicators closely aligned with policy and hence potentially biased towards particular policy priorities at the expense of other aspects of sustainable development, this is also one of their strengths. Policy makers see them as being directly relevant to the policies they have established and effective for communication.

An obvious drawback to indicators that are strongly aligned with a policy framework is that changes in the policy framework can mean the indicators have to follow suit. This is particularly illustrated by the example of the United Kingdom, where there have been three sustainable development strategies and three associated indicator sets since 1996.

Of course, it would be wrong to set the indicators in stone when refinements would be beneficial in terms of coverage or understanding. Moreover, in practice, changes to indicator sets may be on the periphery while at the core there is reasonable consistency between different generations of indicators.

Only minor consideration has been given to international comparability in the development of national indicator sets. This is perhaps inevitable in terms of both differing priorities and data availability among countries. However, for issues that are of global or regional importance, there is broad consistency among countries; for example, most sustainable development indicators sets include an indicator on greenhouse gas emissions.

Within the European Union, at least, there has been some inevitable convergence among national indicators used. This is for two reasons. Firstly, and most obviously, as newer member states develop their indicator systems, they are likely to be influenced by the indicators adopted at the European Union level. Secondly, and less obviously, the indicators used by the European Union itself have been developed through engagement with older member states and those with well-established national indicator sets have been influential in the direction taken by the European Union.

In order to determine the degree to which commonalities exist among policy-based indicators of sustainable development, the Working Group analysed indicator sets from 20 European countries[1] (Eurostat, 2007b; Kulig, Kolfort and Hoekstra, 2007), two countries outside Europe (Australia and Canada), and two international institutions (the European Union and the United Nations).

Based on this analysis, some 27 indicators emerged as being common to 10 or more sets (Table 3 in Chapter II). This list was the basis upon which the Working Group compared existing indicators with those that fall out of the approach based on an extended concept of capital.

[1] Austria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Iceland, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

D. The capital approach in theory

Classical development theory is strongly focused on investment and capital as central determining factors for development. While traditionally restricted to understanding economic development through expansion of markets and increases in human-made capital, the theory is increasingly extended and broadened so that it speaks to the broader question of how to secure sustainable development as well.

From a capital perspective, sustainable development can be defined as non-declining *per capita* wealth over time (United Nations *et al.*, 2003). This definition concords well with that above, but is more nuanced. In particular, it states directly the need to maintain wealth as the basis of sustainable development. It also recognizes that wealth *per capita* is what matters and not just the total wealth of a society. This reflects the fact that populations increase over time and that the rate of increase of wealth must be at least equal to population growth if sustainable development is to be achieved.

All goods and services can be viewed as being produced through the use of capital, normally in conjunction with human labour. Since the concept of sustainable development demands a very broad view of consumption, it is necessary to take an equally broad view of capital.

From this broad view, a society's total capital base is seen to comprise five individual stocks: financial capital like stocks, bonds and currency deposits; produced capital like machinery, buildings, telecommunications and other types of infrastructure; natural capital in the form of natural resources, land and ecosystems providing services like waste absorption; human capital in the form of an educated and healthy workforce; and, finally, social capital in the form of functioning social networks and institutions.

Not all these forms of capital are equally well understood, either conceptually or empirically. Indeed, the order in which they have just been presented reflects well the degree to which they are understood. Social capital, the least well studied of the five, remains a controversial concept for which no single definition is universally accepted.

It should be noted that managing total national wealth in a manner that sustains it over time, measured *per capita*, only provides the potential for sustainable development. This is because there is no guarantee that future generations will manage well the capital base they inherit. They may fail in utilising it effectively to create well-being and instead waste the resources on wars or on excessively "high living" without concern for the well-being of their descendants.

While stable or growing total wealth *per capita* is no guarantee of sustainable development, the opposite is a guarantee of its impossibility. That is, in the face of declining *per capita* capital stocks, well-being will in the long run deteriorate and sustainable development will not be possible (Hamilton and Ruta, 2006).

By taking the perspective of capital, the challenge of sustainable development is simplified into a question of whether a country's total capital base – or total national wealth – is managed in a way that secures its maintenance over time. Thus simplified, the focus of the sustainable

development challenge is sharpened and put into concrete terms. The question whether financial, produced, natural, human and social capital stocks *per capita* are increasing or declining over time is one that lends itself to a precise answer. Furthermore, this focus helps make sense of the inevitable tradeoffs that must be weighed as development proceeds. For example, if one capital stock – let us say, petroleum wealth – declines, the framework allows us to ask whether it is being offset by growth of another stock, human capital perhaps.

E. Limitations on the theoretical capital approach

To reach its full potential, the capital approach requires measurement of all capital stocks using a common unit. The only obvious choice of unit – money – is problematic for two reasons. First, it is difficult to uniquely determine all of the ways in which capital contributes to well-being. Those that cannot be identified obviously cannot be valued. Second, even for those contributions we can identify, it is sometimes difficult to translate their value into dollars. This is partly because functioning markets rarely achieve the ideal conditions economists impose upon them in their valuation methods and partly because the methods themselves remain underdeveloped in some cases.

There is in addition to the debate over the economics of valuation a debate over its ethical underpinnings. Certain observers place a question mark after the right of humans to exploit nature in a destructive manner, even if this, at least in the short run, may increase total national wealth. Clearly, aggregating nature along with other forms of wealth as though humans are indifferent to its existence so long as their well-being is assured is at ethical odds with this view.

A third limitation on valuation is the degree of substitutability among capital types. It is generally accepted that the various components of national wealth cannot always and without difficulty be replaced with each other. It is not so, for instance, that ecosystem services, which may be considered as one of the dividends of natural capital, can easily and always be replaced by increased income, the dividend of financial, produced or human capital. Capital services for which no substitute can be found are said to flow from critical capital stocks. To the extent that some capital stocks are indeed critical, the possibility of using a single monetary aggregate to measure sustainable development disappears. It would be wrong to aggregate values for non-critical capital with those for critical capital into a single measure. In doing so, essential information for sustainable development would be lost.

All of this suggests that a practical implementation of the capital framework cannot rest on monetary indicators alone. Certainly, monetary indicators are desirable and should form part of any set of sustainable development indicators based on capital. Additionally, though, the approach requires separate indicators of critical capital stocks measured in physical units.

F. A practical set of capital-based indicators

It is clear that not all capital stocks can or should be measured in monetary terms. Yet many stocks and/or the goods and services they provide are bought and sold in markets and there is good reason to argue that the market value assigned to these assets (or goods and services) is a close approximation of their contribution to well-being. This is true of all financial and produced capital.

It also applies to those elements of natural capital and related products that are commonly traded in the market; including, timber, fish, minerals and energy. It applies as well to the output of human capital (labour) insofar as it is used in the market.

Using market prices as a guide, then, it is possible to estimate the contribution of a fair range of capital assets to what might be called the economic component of well-being. Given this, extending the valuation of these assets as far as possible into an indicator of market-based economic wealth is an important task in a practical set of capital-based sustainable development indicators. To be precise, the correct form of the indicator is real (inflation-adjusted) *per capita* economic wealth.

Economic wealth is equal to the sum of the value of all assets that contribute to market production, including financial, produced, natural, human and social capital. In practice, it is not possible to observe market values for all capital types directly, so calculating economic wealth by summing just observed values is not possible. Only in the cases of financial and produced capital are market values normally directly observable. Market values for natural capital are observable in some instances[2], but natural assets are generally not traded on markets. Well-established indirect methods based on universal principles of valuation can be used, however, to estimate natural capital values in the absence of market prices (Freeman, 1993). Human capital values are also not directly observable, but again indirect methods exist for valuing it (Greaker, 2007). Most problematic is social capital, where neither directly observed values nor well-established indirect methods exist.

Although economic wealth cannot be measured today by summing observed or estimated values for the five categories of capital, economic theory (Hamilton and Hartwick, 2005; World Bank, 2006) gives us another approach. According to this theory, economic wealth is also equal to the present value of future market income, where market income equals what is spent on market goods and services plus net investment in various types of capital. The World Bank (2006) has discussed this approach in detail and used it as the basis for estimating economic wealth in more than 100 countries.

It should be noted that economic wealth calculated in the above fashion is sensitive to assumptions about future income and to the choice of discount rate. These assumptions must, of course, be made explicit in any use of this method in official statistics.

While economic wealth is an important measure of sustainable development from the capital perspective, it cannot stand alone. It must be supplemented to form a practical and complete indicator set from a capital perspective. Additional indicators must be selected to reflect the well-being effects of capital that cannot or should not be captured in a market-based monetary measure. They must take into consideration the limited substitutability among different forms of capital, the existence of critical forms of capital and the fact that well-being is derived from more than market consumption. Finally, they must take into account the fact that it is not just stocks, but flows too that are important from a capital perspective. Flows are important because they are what determine changes in stocks from one period to the next.

[2] For example, in some countries entire forest tracks are held privately and traded in open markets.

The first necessary extension to the set of capital stock indicators is to complement the aggregate indicator of economic wealth with separate monetary indicators of financial capital, produced capital, human capital, natural capital and social capital. Extending the indicator set in this way takes care of the concern about the non-substitutability of capital stocks at the margin. As with economic wealth, these separate monetary indicators should all be measured in real *per capita* terms.

The next extension of the practical indicator set is necessary to take care of the fact that some capital assets are "critical" to development. One 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, there is reasonable consensus that the following are all very important:

(a) A reasonably stable and predictable climate;

(b) Air that is safe to breath;

(c) High-quality water in sufficient quantities; and

(d) Intact natural landscapes suitable for supporting a diversity of plant and animal life.

There may well be other forms of capital that also have critical elements, including social capital. It is not known yet what these might be, so only a place holder can be set aside within the indicator set at this time.

The next extension to the practical set is necessary to account for the fact that some capital assets contribute to well-being outside of the market place. While this is not a concern for financial and produced capital, it is for natural, human and social capital.

Natural capital contributes to well-being outside the market mainly when humans experience nature directly (for example, when camping) or when they derive pleasure from the knowledge that nature continues to exist. Since many of the same features of the environment that are critical to development are also those from which humans would derive non-market well-being, it is proposed that the same set of physical indicators listed above serve also as the indicators of non-market natural capital.

Human capital also contributes to well-being 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. Indicators are therefore added for the two core dimensions of human capital: educational achievement and health status.

As for social capital, it has been suggested (Grootaert and van Bastelaer, 2002; pp. 31-32) that the focus should be on three types of proxy indicators: membership in local associations and networks, trust and adherence to norms, and collective action.

Though the central focus of the capital approach is asset stocks, the measurement of flows is also integral to the approach. To the extent that an asset changes in value or size over time, there must be identifiable flow that is the cause of the change. Indicators of these flows must be included in the practical set of sustainable development indicators.

When it comes to economic wealth overall, the fundamental flow variable is net investment in all forms of economic assets. This is the value of new investment in these assets during a period net of the depreciation in their value as a result of their use in production. The term "genuine economic savings" is used here to denote this flow.

For financial capital, the fundamental flow variable is net investment in foreign financial assets.

For produced capital, the fundamental flow indicator is net investment. This is the value of new investment in produced capital during a period net of the depreciation of the existing produced capital stock.

For human capital, the fundamental flow indicator is also net investment. This would be the value of the increase in human capital during a period less its depreciation. Depreciation of human capital results from the obsolescence of skills (for example, as workers age and fail to keep their skills up-to-date) and the loss of workers from the labour force as a result of retirement, unemployment or other factors. Investment in human capital occurs through education and training and through improvements to health status.

For natural capital, there are several flow indicators that are important. First, for non-critical forms of natural capital – that is, those that can be meaningfully aggregated together and measured in monetary terms – the fundamental indicator is the aggregate value of net depletion. A separate flow indicator is included for each critical form of natural capital noted earlier.

When it comes to social capital, identifying flow indicators to parallel the proxy stock indicators discussed above is not straightforward. Only the indicator of membership in local associations and networks has an obvious flow parallel: change in membership in these same groups. No obvious flow variable parallels the indicator of trust and adherence to norms or the indicator of collective action. For now, place holders are included for these two flow indicators.

The final set of practical sustainable development indicators based on the capital approach is presented in Table 5 in Chapter IV. In the end, the practical set includes 15 stock indicators. The flow indicators also total to 15, though both of the social capital flow indicators and the indicator of changes in age-specific mortality and morbidity are simply place holders for the time being until research in these areas matures.

Regarding the feasibility of the set, all of the indicators that are not place holders can be estimated today using existing methods and data that are available in most developed nations. Not all of the methods are equally well established however. Some, like those for estimating produced capital, are formally part of official statistical methods. Other methods, like those for measuring

human capital or fragmentation of habitats, exist and are used in the research community but are not established within the framework of official statistics.

G. Comparing the approaches

Based on the set of common policy-based indicators presented in Table 3 in Chapter II and the practical set of capital-based indicators presented in **Error! Reference source not found.**, the following points can be drawn by way of comparison between the two:

(a) First, few monetary indicators are commonly found in policy-based sets, while they figure centrally in the capital-based set. In particular, there is no effort in policy-based sets to measure sustainable development with highly aggregated monetary indicators like economic wealth. Many common policy-based indicators are, however, closely related to the monetary indicators of individual capital stocks even if they are measured in physical terms;

(b) There are very close and even direct relations between a number of common policy-based indicators and the physical indicators of human and natural capital stocks;

(c) Only a few common policy-based indicators cannot be reconciled with the capital approach. Among these, GDP *per capita* is the most important. It is simply not possible to justify selection of any indicator based on GDP as a sustainable development indicator from the capital perspective.

With this summary in mind, attention can be turned to defining – in an exploratory fashion – a small set of sustainable development indicators that might be consistent with the capital approach, relevant from the policy perspective and suitable for comparing performance among countries. Such a set is presented below:

A proposed small set of sustainable development indicators

Indicator domain	Stock Indicators	Flow Indicators
Foundational well-being	Health-adjusted life expectancy	Index of changes in age-specific mortality and morbidity (place holder)
	Percentage of population with post-secondary education	Enrolment in post-secondary education
	Temperature deviations from normals	Greenhouse gas emissions
	Ground-level ozone and fine particulate concentrations	Smog-forming pollutant emissions
	Quality-adjusted water availability	Nutrient loadings to water bodies

	Fragmentation of natural habitats	Conversion of natural habitats to other uses
Economic well-being	Real *per capita* net foreign financial asset holdings	Real *per capita* investment in foreign financial assets
	Real *per capita* produced capital	Real *per capita* net investment in produced capital
	Real *per capita* human capital	Real *per capita* net investment in human capital
	Real *per capita* natural capital	Real *per capita* net depletion of natural capital
	Reserves of energy resources	Depletion of energy resources
	Reserves of mineral resources	Depletion of mineral resources
	Timber resource stocks	Depletion of timber resources
	Marine resource stocks	Depletion of marine resources

As can be seen, the proposed small set has been divided into two indicator domains. The first is labelled foundational well-being to reflect the fact that the indicators measure stocks and flows that are essential to the well-being of society. The second domain is labelled economic well-being. The indicators within it are more narrowly related to the well-being derived from market activity.

In selecting the indicators for inclusion in the small set, the following decisions were made:

(a) As a general rule, to be included in the small set, an indicator had to be both consistent with the capital approach and identifiable with an indicator found among the most common indicators from policy-based sets;

(b) No particular effort was made to include only indicators that are methodologically well-established or feasible today in all countries. Rather, priority was given to selecting a small set that is as robust and complete as possible. As it happens, though, most of the indicators in the set may in fact be developed today using methodologies outlined either in the academic literature or in statistical guidelines. Some of these methodologies – for example, those related to human capital valuation (Jorgenson and Fraumeni, 1987; Jorgenson and Fraumeni, 1992; Wei, 2004) – remain experimental and may not yet meet the standards of official statistics. Not all of them will be feasible in all countries. The small set should therefore be considered a goal to which some countries should aspire, though it is more applicable to countries with well-established statistical systems;

(c) No distribution- or efficiency-based indicators were included in the set. This is not because distribution of wealth and efficient use of assets are unimportant to sustainable development, but because distributional or efficiency versions of most of the indicators in the small set can be easily compiled using basic statistical techniques;

(d) No indicators related to social capital were included. Even though proxy indicators of social capital were included in the proposed list of capital indicators in Table 5 in Chapter IV, it is not felt that these are sufficiently robust either theoretically or methodologically to be proposed for the small set. The fact that only one indicator related to social capital is found among the most common indicators in existing policy-based sets was another reason for excluding social indicators from the small set. Clearly, further research will be necessary before social indicators consistent with the capital approach and relevant to sustainable development policy across a large number of countries can be proposed;

(e) The aggregate monetary indicator of economic wealth was not included. Although this indicator is highly relevant to the capital approach, it is far from what is currently measured in policy-based sets. For that reason, its inclusion in the small set was felt to be unjustified;

(f) The aggregate monetary indicators of financial, produced, natural and human capital were included. The inclusion of the financial and produced capital indicators is consistent with, if broader than, the policy-based indicators of government net debt and research and development expenditure. The inclusion of the monetary natural and human capital indicators is justified in two ways. First, their exclusion would be inconsistent with the inclusion of the financial and produced capital indicators. If the wealth associated with financial and produced capital is considered relevant to sustainable development, then surely so must the wealth associated with natural and human capital. Second, many of the indicators in existing policy-based sets are closely related to human and natural capital, even if they are measured in physical terms. So that the proposed small set is consistent with both the capital approach and existing policy approaches, the small set also includes a number of physical indicators of non-critical natural capital among the economic well-being indicators. Physical indicators of human capital are included among the foundational well-being indicators.

There are 28 indicators in the proposed small set. While this is a large number, it is fewer than in most policy-based sets – in some cases much fewer. The indicators in the small set represent a theoretically robust, substantially complete and policy-relevant approach to measuring sustainable development. Any country that compiled them all would be in a very good position to report upon its potential for sustaining well-being in the long term. If many countries were to compile them as part (or all) of their national sustainable development indicator sets, the basis for comparing progress across nations in terms of achieving sustainable development would be greatly improved. Likewise, the basis for long-term policy making at the national level could be improved by:

(a) Providing a focus on the long-term determinants of development;

(b) Clarifying the distinction between current income and capital consumption;

(c) Defining the concept of investment more broadly; and

(d) Helping balance current well-being with the maintenance of capital.

The set is not of as much use for reporting on the elements of current well-being, though it is far from useless for this purpose. The set will also not correspond perfectly to the policy priorities in

all countries. For both these reasons, any given country might feel that the proposed small set is insufficient to meet its needs for measuring sustainable development. To the extent that this is true, the small set can, of course, be supplemented with additional indicators reflecting the national situation.

It is also worth emphasizing that the small set of indicators on its own should not be thought of as all that is relevant to measuring sustainable development. Indicators by their nature tell a very high-level story. They are valuable for pointing out where a policy may not be having its desired effect, but they are not likely to reveal why this is the case. Thus, to be fully useful for crafting and assessing policies, indicators must be built upon well-organized underlying data structures. Creating such structures requires a measurement framework; that is, a set of methodologies and organizational rules for turning basic data into useful information coherent with an underlying conceptual framework.

The *System of National Accounts* (United Nations et al., 1993) is a good example of a measurement framework and is, in fact, the most obvious starting point for designing a measurement framework for the small set of sustainable development indicators. This is true for several reasons. Firstly, the *System of National Accounts* – or SNA – is already the source for measures of financial and produced capital stocks. Secondly, there already exists a measurement framework for natural capital that is consistent with the SNA. This is the United Nations *System of Environmental and Economic Accounts* (United Nations et al., 2003). Thirdly, while no fully developed SNA-based measurement framework for human capital exists, it is the case that many of the data required to compile estimates of human capital are available from the SNA. Thus, it is reasonable to suggest that an SNA-based measurement framework for human capital could be easily conceived.

H. Conclusion

Sustainable development is a popular and important concept, but one that is difficult to define with precision and, therefore, difficult to measure. The Working Group on Statistics for Sustainable Development has attempted to contribute to this undertaking by drawing the best from the conceptual work of researchers and the practical work of policy makers and statisticians. Its efforts can be viewed as a success from a number of perspectives.

Importantly, over the course of two years of discussions, there emerged a significant convergence of opinion among the members of the group. While at the outset there was doubt on the part of some about the value of an approach based on capital and doubt on the part of others of the effectiveness of existing indicator sets, at the end there was greater understanding of the role each has to play. For this alone, the work of the group can be considered to have been worthwhile.

The very thorough discussions of the capital approach have helped clarify many of the concepts that are central to it and, more importantly, have identified where further work is needed to clarify these concepts if they are to become more widely accepted. In particular, further work is proposed to more fully assess the methods for estimating economic wealth, to refine the proposed indicators of critical capital and to better define social capital.

Finally, and most importantly, the work of the group has lead to the proposal of practical set of sustainable development indicators that might serve as the basis for international comparisons. This set is consistent with the capital approach and with the most common elements of existing policy-based indicator sets. It is relatively small and has a high degree of internal coherence.

The small set of indicators is offered in an exploratory fashion only. It is not intended as an international recommendation, but as a research proposal worthy of consideration by countries interested in finding a conceptually clear and defensible basis for sustainable development indicators focused on long-term well-being.

Chapter I: INTRODUCTION

The present report is prepared by the Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development, which was mandated to propose a small set of sustainable development indicators that could be used for the purposes of international comparison. The results of the group's efforts are presented in detail in the following six chapters.

This introductory chapter describes the background for the work, outlining the mandate given to the Working Group, its composition and its mode of operation. Also discussed are a number of basic concepts referred to throughout the report, some of which were widely debated during the group's deliberations. Rationales are provided for taking a conceptually based approach to measuring sustainable development and for adhering to the principles of official statistics.

Chapter II gives an overview of some of the existing policy frameworks and indicators in countries and international organizations for measuring sustainable development and analyzes them to identify commonalities. A list of the most common indicators in existing sets is presented.

The capital approach itself is set out in theory in Chapter III and then in more practical terms in Chapter IV. The capital approach is based on the notion that sustainable development requires non-declining well-being over time and that this goal can be realised only if a nation's total resource base, or national wealth, is preserved over time.

This list then becomes the basis of comparison, in Chapter V, of the most common existing indicators with a theoretically based set of indicators derived from the capital approach to measuring sustainable development. It is shown that there is, in fact, a high degree of coherence between the indicators derived from the two approaches.

Chapter VI concludes with a summary of the Working Group's findings and an agenda for future research.

Although formally prepared for statistical offices in the UNECE, OECD and European Union member states, this report targets other audiences as well. It will benefit statisticians of any country in need of conceptual guidance on the measurement of sustainable development. At the same time, the general reader will find it helpful in understanding how sustainable development might be measured in concrete terms, as well as the strengths and weaknesses of different approaches. Policy makers whose task is to ensure sustainable development will find in it an approach with which they may not be fully familiar – the approach based on capital. They will see this approach compared with existing national indicator sets derived from policy frameworks with which they will likely be more familiar. It is hoped that this comparison will help ignite a discussion about new ways of measuring sustainable development.

A. The Working Group on Statistics for Sustainable Development

Mandate and functioning of the Working Group

Sustainable development indicators are used increasingly by national governments and international agencies for monitoring progress towards sustainability goals as well as comparing performance among countries. The Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development, henceforth the Working Group, was established by the Bureau of the Conference of European Statisticians (CES) in 2005 in order to provide a theoretical and conceptual framework and to better structure the work on indicators. 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.

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 Annex 3 for the full mandate).

Furthermore, the mandate required the Working Group to:

(a) Articulate a broad conceptual framework for sustainable development measurement with the concept of capital at its centre; consider other approaches to the extent the capital approach is found insufficient from a conceptual standpoint;

(b) Identify the broad domains that good indicator sets should span;

(c) Develop a menu of good sustainable development indicators in order to help governments and international organizations when they are designing indicator sets;

(d) Identify a small set of indicators from the menu that might become the core set for international comparisons;

(e) 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); and

(f) Discuss the relationship between integrated environmental and economic accounts and sustainable development indicators.

In October 2006, the Bureau of the CES provided, at the request of the Working Group, further clarification of the mandate as follows:

(a) The Working Group was encouraged to thoroughly explore the approach to measuring sustainable development based on the four types of capital – economic, natural, human, and social. However, in each of the four capital areas, the Working Group was encouraged to go only as far as it could in a conceptually sound manner;

(b) The Working Group should limit itself to looking at existing indicator sets in countries that have adopted policy-based approaches to the measurement of sustainable development in order to reveal commonalities among the existing indicators and commonalities with indicators derived from the capital approach. The group should only highlight the commonalities rather than develop recommendations.

The Working Group was open to participants from national statistical offices and other government bodies of all countries that are members of the UNECE and OECD. Attendance at meetings totalled forty to fifty participants on average, largely from statistical offices. Participants also came from ministries of environment, planning ministries and finance ministries. A list of participants in included in Annex 2.

Robert Smith from Statistics Canada served as the chair of the Working Group. From February 2007 to April 2008, Knut H. Alfsen from Statistics Norway, with support from the Ministry of Finance of Norway and Statistics Norway, served as editor of the report. Tone Smith, also from Statistics Norway, who was seconded to the OECD in 2006, provided some secretarial and research support.

Steering Committee of the WGSSD

The Bureau of the CES established a Steering Committee in order to guide the work of the Working Group. The terms of reference for the Steering Committee are presented in Annex 4.

Members of the Steering Committee included Robert Smith (Chair, Statistics Canada), Stephen Hall (Department of the Environment, Food and Rural Affairs, United Kingdom), 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 Giovannini (OECD), Kirk Hamilton (World Bank), and Pascal Wolff (Eurostat). Vania Etropolska (UNECE), Tone Smith (OECD) and Laure Ledoux (Eurostat) contributed to and participated in the work of the Steering Committee for part of the period. The editor, Knut H. Alfsen, participated in the Steering Committee meetings during 2007 and 2008.

The Working Group met five times over the course of its mandate: Luxembourg, 3-4 April 2006; Oslo, 15-16 November 2006; Geneva, 19-20 April 2007; Bucharest 8-9 November 2007; and Lisbon, 5-6 March 2008. During the course of its work, the Group provided regular progress reports to the Conference of European Statisticians and its Bureau, and to the OECD Annual Meeting of Sustainable Development Experts.

B. Basic concepts

The concept of "sustainable development" was popularised as a normative goal by the World Commission on Environment and Development[3] in their 1987 report to the General Assembly of the United Nations Our Common Future (World Commission on Environment and Development,

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

1987). There 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".[4] This definition suggests the need to balance two concerns, one having to do with present, or intra-generational needs and the other having to do with future, or inter-generational needs.

While less than precise, the Brundtland definition agrees with the intuition that, since the term sustainable means "can be continued" or "lasting", sustainable development is development that can be continued into the indefinite future. Since "sustainability" in itself has no intrinsic value (some states of development may be sustainable but hardly worth sustaining), the challenge of the concept is perhaps not so much in the word "sustainable" but in "development" (Pearce and Warford, 1993, p. 42). Thus, to understand sustainable development with any precision, it is important first to define what is meant by development. This, in turn, leads quickly to the need to define human well-being.

Defining the concepts of development and human well-being is necessary but not sufficient for agreeing upon a definition of sustainable development. Agreement on the latter proved problematic for the Working Group – just as in the world at large. While all members were willing to accept the Brundtland definition as a starting point, opinion was divided as to its interpretation. One part of the Working Group wanted to emphasise the inter-generational dimension, while the other argued for equal emphasis on both intra- and inter-generational issues.

C. What is understood by development?

Development, most people would agree, is a term with a positive connotation; that is, development is associated with a better future. However, whether a given change is regarded as good or bad involves value judgements over which it is often difficult to come to agreement. This is not least because what we consider good or bad changes over time and is subject to different interpretations according to differences in perspectives.

Traditionally, economists have measured development in terms of increasing *per capita* income, or gross domestic product. But if the distribution of income is skewed and the poor part of the population is getting poorer even while average income increases, many people – including many economists – would hesitate to call this development.

The UN Development Program (1994) defines development as processes that increase people's opportunity of choice. Ecologists, for their part, would tend to regard processes that threaten environmental robustness as negative even if they benefit people.

Others would highlight the state of education and health in the society as important factors in meeting basic needs. Education creates knowledge, skills and capabilities allowing greater individual choice and freedom and, as such, is an important part of development.
Finally, institutional arrangements and governance have important ramifications for individual freedom and choice and are, according to some, essential parameters by which the level of development should be judged.

[4] A great number of alternative definitions of sustainable development exist.

What all these ideas share in common is a focus on making humans better off in one way or another. Therefore, for the purposes of this report, development will be thought of as an increase in well-being across the members of a society between two points in time. While helpful, this definition raises the secondary question of what defines well-being.

D. Well-being

Well-being is often used as a synonym for welfare, though the terms can have different formal meanings – particularly to economists. In defining well-being, it is therefore necessary first to discuss welfare. This, in turn, requires a prior discussion of utility.

Utility is the benefit an individual derives from consuming goods and services. It is generally thought of as benefits enjoyed in a given instant. Economists have another term to describe the benefits of consumption over time. This they call welfare and it is formally defined as the discounted present value of future utility. If consumption is measured for all members of a society, then this discounted present value is termed social welfare.

According to Dasgupta (2001, p. 14), welfare can be understood as the value an individual attaches to his or her personal circumstances in a particular social state. A social state describes the allocation of scarce resources (who gets what, when, where, and why) and anything else deemed to be relevant for personal or social choice. Samuelson (1961, pp. 50–57), in a seminal work on the topic, noted that "in the space of all present and future consumption . . . the only valid approximation to a measure of welfare comes from computing wealth-like magnitudes."

From these insights we can draw the following important conclusion. The way in which access to resources – another way of saying consumption opportunities – is distributed across individuals and their expectations of how they will benefit from that access are at the heart of welfare. This means, as Samuelson observed, that welfare is very closely related to what we think of as wealth, as wealth represents the totality of resources upon which we are able to draw to support ourselves over time. From this it is clear that welfare is a forward looking concept in which what counts is not how well off we are at a point in time, but our prospects for being well off in the future. In other words, welfare is an intertemporal concept.

As for well-being, there is no single definition and there remains considerable debate regarding its determinants. What makes us feel contented is still as much a matter of opinion as it is of science. The common use of well-being as a synonym for what would more formally be called welfare has already been noted. However, some use it formally in a broader sense.

Dasgupta (2001, p. 15), for one, notes that well-being encompasses welfare but goes beyond it to include benefits derived from things other than consumption; for example, from the presence of fundamental human rights. Other determinants of well-being according to this view could include social relations and psychological fitness. This remains an emerging area of inquiry and there is no suggestion of having treated it in this report.

While a formal distinction between welfare and well-being may be of importance in academic debate, it is not of great importance to the conclusions of this report. For this reason, and because it

may be the more encompassing term, well-being is used almost exclusively in the remainder of this report. The only exceptions are where its use could lead to confusion with respect to formally defined concepts.

A central theme in Chapter III, in which the capital approach to sustainable development is described, is that the concept of well-being has much potential for measuring sustainable development if it is broadened beyond its traditional scope in economics. Economists are interested mainly in the well-being derived from consumption as traditionally defined: the enjoyment of goods and services purchased in the market. But if it is to be useful for measuring sustainable development, well-being must be seen to be a function of consumption in the broadest sense possible. Consumption in this sense must include the enjoyment of any good or service that contributes to well-being, including things freely provided by nature like forest products and beautiful sunsets. It is possible even to think of the enjoyment of the benefits of human rights or psychological fitness as being forms of consumption.

Summarizing the discussion to this point, development has been defined as an increase in well-being across members of a society and well-being has been seen to be a function of consumption broadly defined. The next step is to see how these ideas fit in with the notion of sustainable development.

E. What is understood by sustainable development?

It seems reasonable to interpret sustainable development as development that can continue "forever" or at least for a very long time; say, for several generations. Given the discussion in the previous sections, this statement can be put more fundamentally: sustainable development is increasing well-being over a very long time. Yet more fundamentally: sustainable development is increasing consumption, following its broadest economic interpretation, over a very long time.

It is clear that the time dimension is crucial in sustainable development; it is a dynamic concept. It is a development path that can or cannot be continued over a very long time. Any given point along the path will be difficult, if not impossible, to characterise as sustainable. The reason is that innumerable alternative development paths follow from a given point. Some of these paths will be sustainable and others will not.

However, simply being sustainable does not make a development path desirable. It also matters whether it is the sort of development path society wants to follow and this depends on what determines well-being for its members. Measuring well-being at points over time gives evidence whether the current development path is in line with societal goals and hence worth sustaining or not.

Upon these basic points, all members of the Working Group agreed. It must be acknowledged, though, that the group's views diverged importantly on other points. Differences arose, in particular, regarding the relationship between short- and long-term well-being and sustainable development. These differences are acknowledged not to unduly emphasize points of disagreement within the group, but simply to provide an understanding of the context within which the group's discussions took place.

One view within the group, which in this report is called the integrated view, held that the goal of sustainable development is to ensure both the well-being of those currently living and the potential for the well-being of future generations. The second, labelled the future-oriented view, held that the concern of sustainable development is properly limited to just the latter; that is, sustainable development is about ensuring the potential for the well-being of future generations. Each of these views is taken up briefly below, starting with the integrated view.

F. Two views of sustainable development and current well-being

In a world of limited resources the main issue from the **integrated view** is to reconcile present and future needs. Two forms of distributional justice have to be balanced: the inter-generational and the intra-generational. The former, justice between generations, is about securing freedom and options to exist and develop for the generations to come. The latter, justice within a generation, is about securing freedom and options to exist and evolve for today's world population. One is not to be achieved at the detriment of the other.

According to the integrated view, a framework for measuring sustainable development must be able to illustrate – in a perspective of both time and space – whether and for whom freedom to pursue well-being is increasing or declining, how access to and appropriation of resources are distributed, how the negative effects of resource use are distributed and to what extent resources are used in a responsible manner with regard to meeting current and future needs. That is, the measurement of sustainable development must focus on both the options of the current generation and on the prospects for those yet to come. This view finds support in, among other arguments, the definition of sustainable development put forth by the Brundtland Commission.

The principle strength attributed to the integrated view is its ability to bring the two aspects of distributional justice together. For decades, short-term goals related to economic and social development, on the one hand, and longer-term goals related to environmental preservation, on the other, have followed separate paths. It is argued that the particular achievement of the integrated view has been to bring the two together in decision making. Treating the two issues separately again would be seen as a step backwards to the time before United Nations Conference on Environment and Development in Rio de Janeiro in 1992.

The second, future-oriented view of sustainable development sees sustainable development quite differently. Rather than viewing the separation of short-term development objectives and longer-term sustainable development objectives as a step backward, this separation is seen as essential to realizing sustainable development's full potential. Adding the modifier "sustainable" before the noun "development" changes the intent entirely according to this view, placing the focus squarely on inter-generational issues. Ensuring short-term well-being – including an equitable distribution of access to resources – is simply seen as development as it has been understood in the western world for decades.

The future-oriented view says that it is only by limiting the scope of sustainable development to future well-being that the concept can offer focused policy direction. By distinguishing sustainable development from development as we traditionally think of it, the future-oriented view is a call for policy to ensure the elements of future well-being are passed on in good condition by

today's generation. Eliminating all of the issues associated with current well-being from consideration, clears the way for sustainable development policies to focus on ensuring future well-being. This narrower scope for a policy approach more apt to succeed than the all-encompassing one imposed by the integrated view.

By including essentially all policy issues – social, economic, environmental and short- and long-term – in the integrated view, everything of social value falls under the sustainable development umbrella. With nothing exogenous, or outside the framework, only limited new insight into decision making is provided. If everything is sustainable development, it is hard to know where to focus. This all-encompassing view can also lead one to pay too little attention to simple rule that "there is no free lunch." In other words, resources used today to combat, for instance, poverty are not available to address climate change for the future.

On the practical front, it is also noted that there are massive and long-standing efforts on the part of governments, communities and individuals to promote development in the short-term. Equally, much of official statistics is today focused on measurement of the success of these efforts. However, the same is not true of efforts to ensure that development is sustainable in the long-term. These efforts are much less the focus of policy and even less so the focus of official statistics.

The final point made in favour of the future-oriented view is that there exists a conceptually robust and well documented body of thought developed over many years that can guide the measurement of long-term sustainable development. The measurement of current well-being, in contrast, remains a more controversial domain where no single viewpoint exists. Devising a conceptually sound set of indicators for the future-oriented view is, then, an easier task than doing so for the integrated view.

The principle criticism of the future-oriented view is that it leaves out of consideration much of what the Brundtland Commission had in mind when it discussed sustainable development. The Brundtland definition clearly states that sustainable development is, in part, "about meeting the needs of the present." How then, can the future-oriented view, which explicitly excludes these needs from consideration, be legitimate?

A related criticism is that the future-oriented view is at odds with the way in which sustainable development is interpreted by most governments. Like Brundtland, most countries that have developed national sustainable development strategies insist that the concept must cover both short-term and long-term well-being. A view that excludes the former is argued by some to be of limited relevance.

A final criticism levelled at the future-oriented view is that it ignores an important equity concern that sustainable development has managed to move higher on many national policy agendas. This is the concern for the world's poorest. The disparity between the rich and the poor in many countries today is clearly a problem most citizens would not wish to sustain in the future. Societies have preferences regarding equity both among their own members and between themselves and other societies. The distribution of resources across individuals will therefore have an effect on current well-being and thus be a relevant issue when determining whether a given

development path is worth sustaining or not. If it is determined not to be, a key issue is ensuring that the new development path taken to eliminate poverty is, at the same time, sustainable.

It is recognized that the two perspectives held by the group are not entirely independent of each other. There are links between current and future well-being. If pollution is high today and well-being lower as a result, this is relevant in many ways to the prospects for future well-being. But our understanding of how current well-being is linked to future well-being is highly imperfect, with a few exceptions like poverty. If it were better, proposing a conceptually robust set of indicators for the integrated view would be easier.

There was no attempt by the group to resolve the above debate. Rather, the members acknowledged it and moved on with their mandate to explore the commonalities between existing national and international indicators of sustainable development, most of which are founded on the integrated view, and the indicators that fall out of the capital approach, which is aligned with the future-oriented view. The results of this exploration, discussed in Chapter V, show that there are many commonalities between the approaches, offering hope that a single set of sustainable development indicators can be found to satisfy both views.

G. On the need for a conceptual approach

Defining and measuring sustainable development are two different things. Given the difficulty in precisely defining sustainable development, it should come as no surprise that it has proven just as hard to agree on a single, limited set of indicators for measuring it. Ample evidence of the diversity and breadth of existing sustainable development indicators sets will be provided in Chapter II. While diversity and breadth are not undesirable in and of themselves, and can even be an advantage in an emerging area like the measurement of sustainable development, they do mean that sustainable development indicators today lack some of the hallmarks of official statistics; notably, international comparability and consistency over time.

The following quote from Dasgupta (2001, p. 178) puts the argument in favour of a conceptual approach clearly:

> "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."

Indicators, by their very nature, are focused. They cannot give comprehensive information about the system they are designed to describe; in this case, about sustainable development. Their main task is to provide signals regarding the system's state and evolution. For them to work well in guiding decision making, indicators cannot stand alone, but should be part of an overall information system resting upon basic statistical data.

As Dasgupta notes, a clear framework is one way in which integrity can be maintained when the inevitable corners must be cut in establishing such an information system. A framework can help prioritise the content of system so that corners can be cut as little as possible where the impact is greatest. It can also help establish proxies for measures that are key to the system's utility but impractical.

H. On adherence to the principles of official statistics

While national statistical offices have usually been involved in the development of sustainable development indicators, their compilation and publication in many countries and international organisations is the responsibility of environment ministries or other bodies outside the statistical community. Existing indicators often draw upon official statistics as data sources, but also upon other kinds of information. They are sometimes, but not always, published as part of official statistics.

As alluded to above, sustainable development indicators and their underlying data should ideally bear the same "hallmarks" as other official statistical information. This means they should adhere to the fundamental principles of official statistics established by the United Nations,[5] notably the following:

(a) Methods and procedures for the collection, processing, storage and presentation of statistical data need to decided according to strictly professional considerations, including scientific principles and professional ethics;

(b) Information on the sources, methods and procedures used in the preparation of statistical data need to be presented according to scientific standards in order to facilitate their correct interpretation;

(c) Internationally accepted concepts, classifications and methods should be used in the compilation of statistical data to promote the consistency and efficiency of statistical systems at all official levels.

Adherence to these and the other principles of official statistics would ensure that sustainable development indicators:

(a) Provide objective information to inform decision making; for example, for national strategies on sustainable development;

(b) Have a scientifically defensible underpinning;

(c) Are consistent over time and from one country to the next; and

(d) Meet pre-defined quality standards.

[5] See http://unstats.un.org/unsd/dnss/gp/fundprinciples.aspx

I. On the appropriate geographical scale for sustainable development indicators

A sub-global geographical unit such as a nation state cannot meaningfully be said to be sustainable if the globe as a whole is deeply unsustainable. In the long run, everybody will have to be aboard the "development ship" if the trip is to last for a long time – and be enjoyable. For this reason, it may be tempting to conclude that sustainable development only makes sense for the planet as a whole. If this were true, national sustainable development indicator sets would serve no real purpose.

At the same time, political actions and the potential to change development paths is predominantly a regional, national or even local privilege. For this reason it remains imperative to measure whether sub-global entities – particularly nations, but also sub-national jurisdictions and supra-national groupings like the European Union – are developing sustainably. If it were true that every nation were sustainable when measured against a common and scientifically sound set of indicators, then the globe could be comfortably assumed to be sustainable too.

This then is the twin aim of sustainable indicator sets: to show whether or not nations and their associated supra- and sub-national entities are managing their own territories in a sustainable manner and whether or not they contribute to global sustainability.

Chapter II: OVERVIEW OF EXISTING APPROACHES

This section provides an overview of existing approaches to measuring sustainable development in countries and international institutions. As will be seen, there is much diversity among these approaches and, yet, a considerable degree of commonality with respect to sustainable development themes and individual indicators.

A. Introduction and brief history of existing indicator sets

While indicators of sustainable development were discussed in the environmental economics literature as early as the 1970's, a renewed call for such indicators was formulated in *Agenda 21*, one of the main documents coming out of the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro (United Nations 1992). *Agenda 21* was adopted by 183 governments at UNCED. Its full implementation was strongly reaffirmed at the World Summit on Sustainable Development held in Johannesburg, South Africa in 2002, ten years after the Rio de Janeiro conference.

On the need for new indicators, *Agenda 21* (paragraph 40.4) states 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."

Further on, *Agenda 21* calls for (paragraphs 40.6-7):

"a) Development of indicators of sustainable development

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

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."

Following UNCED in 1992, the United Nations Commission on Sustainable Development (UNCSD) was established with one of its tasks being to monitor countries' efforts in developing and using sustainable development indicators. UNCSD developed a set of sustainable development indicators and about 22 countries[6] along with Eurostat tested the proposed methodologies (United Nations, 1996). This work showed that some of the proposed indicators were not that well oriented to national needs (Eurostat, 1997).

Some countries developed their own sustainable development indicator sets. Switzerland, the United Kingdom, Germany, Sweden, and Belgium, to name a few in Europe, were among those 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 the longest experience with sustainable development indicator sets supporting policy monitoring, the first being in 1996 (United Kingdom 1996), the second in 1999 (United Kingdom 1999a) and the third in 2005 (United Kingdom 2005a).

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). Eurostat established a task force of national experts in 2001 to develop a set of sustainable development indicators to support the European Union sustainable development strategy. A first set of indicators was adopted in 2005 and subsequently reviewed in 2007.

The 2002 UN 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 the summit. Increasingly, sets of indicators have been established to be used to assess progress towards goals in national plans or strategies for sustainable development.

National statistical offices have not always taken the lead in the development and publication of sustainable development indicators. In many countries, the lead organization has been a policy department or agency, or indeed a non-governmental organization. However, the indicators have often been strongly dependent on the outputs of national statistical offices, requiring their engagement, and the indicators are themselves in some instances regarded as official statistics.

[6] Ghana, Kenya, Morocco, South Africa, Tunisia, China, the Maldives, Pakistan, Philippines, Austria, Belgium, Czech Republic, Finland, France, Germany, United Kingdom, Barbados, Bolivia, Brazil, Costa Rica, Mexico and Venezuela.

B. Policy-based indicators – the predominant approach

The focus of countries in establishing indicators sets has been generally to meet the information needs of a national sustainable development strategy.[7] It is relatively rare that such strategies have been based on an explicitly defined conceptual framework. Unsurprisingly, few indicator sets exist that are based on the concept of capital, though there are some notable exceptions: Norway (Moe 2007), Canada (Smith, Simard and Sharpe, 2001), the World Bank (World Bank, 2005), Switzerland (FSO/FOEN/ARE 2004a) and Belgium (Federal Planning Bureau of Belgium, 2006).

It is common for indicator sets to be the result of rigorous consultation inside and outside government to ensure that different perspectives on sustainable development are taken into account. Their establishment has been for many countries and institutions a key opportunity to move environmental issues higher up the policy agenda alongside economic and social issues. The sustainable development indicators have also been instrumental in promoting the concept of sustainable development in a much clearer way than can be achieved through national sustainable development strategies alone.

In many cases the relationship between indicators and policy is very strong – with the policy framework in effect determining the indicators. While there may be concerns about having indicators closely aligned with policy and hence potentially biased towards particular policy priorities at the expense of other aspects of sustainable development, this is also one of their strengths. Policy makers see them as being directly relevant to the policies they have established and effective for communication.

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.

There are very few examples where countries or institutions have provided a full and detailed documentation of how they have elaborated and selected their indicators. Instead the indicators are seen to some extent as being natural complements to the policy framework. In reality, however, behind the choice of indicators often lies extensive consideration of data availability and discussion of how best to present the indicator to communicate the policy issue effectively. The indicators – like the policy frameworks upon which they are based – are usually seen to have legitimacy as the result of wide consultation rather than on the basis of a conceptual framework.

Sometimes it may be impractical to develop certain indicators called for in a policy set owing to data unavailability. Their absence may give the false impression that a particular issue has been overlooked. Some countries will include the indicator in their published information in any case, noting it as "to be developed," but this approach is not used universally.

[7] The terms "strategy" and "policy framework" are used interchangeably in this chapter.

Where a framework for the indicators has been expressed explicitly, it sometimes very simply takes the form of the "three pillars" approach, where the pillars are usually economy, society and the environment. In other cases, the framework may be based on the pressure-state-response (PSR) approach developed by the OECD.[8] As noted above, the capital framework can be found explicitly behind only a handful of indicators sets, though in few more cases the framework may be implicit in the thinking behind the indicators and their associated policy framework. For example the policy framework established for the United Kingdom in 1999 refers to economic, social, human and environmental capital and elaborates this in terms of flows such as emissions, waste, investment flowing from economic to environmental capital; and health and living conditions flowing from environment to human and social capital (Hall 2006).

An obvious drawback to indicators that are strongly aligned with a policy framework is that changes in the policy framework can mean the indicators have to follow suit. This is particularly illustrated by the United Kingdom example, where there have been three sustainable development strategies and three associated indicator sets since 1996. However, since the United Kingdom was a pioneer in the development of sustainable development strategies and indicators, revisions to its set are perhaps inevitable.

Of course, it would be wrong to set the indicators in stone when refinements would be beneficial in terms of coverage or understanding. Moreover, in practice, changes to indicator sets may be on the periphery while at the core there is reasonable consistency between different generations of indicators.

Only minor consideration has been given to international comparability in the development of national indicator sets. This is perhaps inevitable in terms of both differing priorities and data availability among countries. However, for issues that are of global or regional importance, there is broad consistency among countries; for example, most sustainable development indicators sets include an indicator on greenhouse gas emissions.

Within the European Union, at least, there has been some inevitable convergence among national indicators used. This is for two reasons. Firstly, and most obviously, as newer member states develop their indicator systems, they are likely to be influenced by the indicators adopted at the European Union level. Secondly, and less obviously, the indicators used by the European Union itself have been developed through engagement with older member states and those with well-established national indicator sets have been influential in the direction taken by the European Union.

C. Status, themes and commonalities – a comparison of existing indicator sets

In assessing the commonalities among existing indicator sets, use was made primarily of a Eurostat study entitled *Improvement of Structural and Sustainable Development Indicators* (Eurostat, 2007b), which includes an analysis of national sustainable development strategies, national indicators and the relationship with indicators established for European Union. The results

[8] Later extended to Driver-Pressure-State-Impact-Response (DPSIR), adopted by UNDP in 1997 and used by EEA.

of a Statistics Netherlands study of existing indicators (Kulig, Kolfort and Hoekstra, 2007) were also used as a basis for the assessment.

While both these studies were limited predominantly to European Union countries, it was considered that the results provided a sufficiently representative picture of existing indicators to negate the need for in depth analysis of indicator sets developed elsewhere. However, it is recognised that sustainable development indicators are not limited to Europe.

The objectives of the Eurostat study included:

(a) Systematic analysis of the priorities set by the national sustainable development strategies through indicators;

(b) Systematic comparison of the use of sustainable development indicators between member states with the priorities and indicators used at the European Union level;

(c) Identification of trends in the use of indicators by member states.

The study covered the 25 member states existing in 2007 and the acceding, candidate and European Economic Area countries at that time. Particular challenges it faced included determining when a national policy strategy related to the economy, society or the environment was truly a sustainable development strategy and, likewise, when a set of indicators truly measured sustainable development. The size of indicator sets also varied considerably between countries and a number of countries had both a "headline" set and a wider "core" set of indicators. In addition, the reported number of indicators in a given country may have understated reality; for example, where individual indicators consisted of several component indicators. All these issues made comparative analysis based on the study difficult. As a result, it has not been possible to include all countries covered by the study in the current analysis.

The number of national sustainable development indicators in the countries for which comparative analysis was possible ranged from 12 to 187 with component indicators taken into account. In some cases, the indicators were found embedded in national policy frameworks and, in others, in separate indicator reports (Table 1).

Table 1. Number of indicators in selected national sustainable development indicator sets

Country	Total	Source
Austria	95	Decision of the Ministerial Council
Belgium	45	2005 Federal Report
Czech Republic	36	2006 Progress Report
Denmark	119	National strategy for SD
Estonia	95	2006 Indicator Report

Finland	35	National strategy for SD
France	12	National strategy for SD
Germany	28	2006 Indicator Report
Greece	70	2003 Report on Sustainability Indicators
Iceland	56	National strategy for SD
Ireland	36	2002 Report
Latvia	187	2003 Report
Lithuania	75	National strategy for SD
Luxembourg	27	2006 Indicator Report
Malta	24	National strategy for SD
Netherlands	32	2004 Report
Norway	16	2005 Report
Portugal	125	National strategy for SD
Romania	13	National strategy for SD
Slovakia	71	National strategy for SD
Slovenia	71	2006 Development Report
Spain	74	National strategy for SD
Sweden	91	National strategy for SD
Switzerland	163	2004 Indicator Report
United Kingdom	147	2006 Indicator Report

Analysis was undertaken to identify commonalities among countries both in terms of indicator themes – or broad issues related to sustainable development – and in terms of specific indicators. Based on indicator sets from 22 countries, including two countries outside Europe (Australia and Canada), and two international institutions (European Union and United Nations)[9], 11 broad indicator themes emerged. The themes are shown in Table 2, along with the number of national and international indicator sets in which each is found. Note that only themes appearing in 10 or more indicators sets are shown. A further 12 themes were evident, although not as commonly used.

[9] Australia, Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Iceland, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, European Union, United Nations.

Determining the most common indicators across countries was challenging because of the various ways in which an indicator of a specific issue can be expressed; for example, otherwise identical indicators might be normalized *per capita* or per unit of land area.

Table 2. Most common sustainable development indicator themes in policy-based sets

Rank	Themes	Number of indicators sets where found*
1.	Management of natural resources	24
2.	Climate change and energy	21
3.	Sustainable consumption and production	20
4.	Public health	19
5.	Social inclusion	19
6.	Education	19
7.	Socio-economic development	18
8.	Transport	16
9.	Good governance	16
10.	Global dimension of sustainable development	16
11.	Research & Development, Innovation	15

*Themes appearing in 10 or more indicator sets.

Considering the same countries/institutions as in Table 2, 27 specific indicators were found to be common to 10 or more national indicator sets (Table 3). The indicators were identified in terms of their broad similarity and not necessarily by the specifics of their expression.

Table 3. Most common sustainable development indicators in policy-based sets

Rank	Broad indicators	Number of indicator sets where found*
1.	Greenhouse gas emissions	22
2.	Education attainment	19
3.	GDP *per capita*	18
4.	Collection and disposal of waste	18
5.	Biodiversity	18

6.	Official Development Assistance	17
7.	Unemployment rate	16
8.	Life expectancy (or Healthy Life Years)	15
9.	Share of energy from renewable sources	15
10.	Risk of poverty	14
11.	Air pollution	14
12.	Energy use and intensity	14
13.	Water quality	14
14.	General government net debt	13
15.	Research & Development expenditure	13
16.	Organic farming	13
17.	Area of protected land	13
18.	Mortality due to selected key illnesses	12
19.	Energy consumption	12
20.	Employment rate	12
21.	Emission of ozone precursors	11
22.	Fishing stock within safe biological limits	11
23.	Use of fertilisers and pesticides	10
24.	Freight transport by mode	10
25.	Passenger transport by mode	10
26.	Intensity of water use	10
27.	Forest area and its utilisation	10

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

D. Case studies

The experience of the European Union, the United Kingdom and Switzerland are presented below to provide a more thorough sense of the processes by which policy-based sustainable development indicators have been developed. Many other examples could have been drawn upon and the experiences outlined below are not meant to be representative of those in all countries.

As noted earlier, Switzerland is one country in which the capital approach was explicitly adopted in a national sustainable development strategy. Norway is another such example. It adopted the capital approach in its National Strategy for Sustainable Development and the associated set of indicators. Norway also differs from most countries in that the Norwegian Ministry of Finance coordinates the government's work on sustainable development, while Statistics Norway coordinates the preparation of the sustainable development indicators.

The European Union

After a first commitment in 2001, the European Union adopted a renewed sustainable development strategy in 2006. This built on the 2001 strategy and incorporated subsequent commitments such as the external dimension and the plan of implementation of the Johannesburg World Summit on Sustainable Development. The strategy has an explicit focus on long-term issues, which is reflected in the policy priorities. Its main goal is the continuous improvement of the quality of life and well-being on Earth for present and future generations. It translates the vision of sustainable development into an operational strategy, which contains in addition to policy guiding principles, some key challenges (climate change and clean energy, sustainable transport, sustainable consumption and production, conservation and management of natural resources, public health, social inclusion, demography and migration, global poverty and sustainable development challenges) detailed with objectives, targets and priority actions. The European Union Strategy also recognises the need for indicators of sustainable development and the role of Eurostat for developing them, with the assistance of a formal Working Group, and monitoring progress.

Eurostat actively supported the testing phase of the United Nations Commission for Sustainable Development's initial indicator set and produced in 1996 a pilot study containing 46 indicators based on the United Nation's proposal of 134 sustainable development indicators. Drawing upon and extending the United Nation's revised list of 59 core indicators, Eurostat issued in 2001 a second publication, containing some 63 indicators.

Following the adoption of the first strategy in 2001, the Statistical Programme Committee (chaired by Eurostat) established a task force to develop a common response from the European statistical system to the need for indicators on sustainable development. The task force, comprising statisticians, researchers, members of national administrations, and representatives from other European Commission services, met between 2002 and 2005. The European Commission endorsed a first set of 155 indicators based on the work of the task force in February 2005. The indicator list was reviewed in 2007 to adjust it to the renewed strategy and comprises now 122 indicators, plus 11 contextual indicators. The indicator set also describes indicators which are not yet fully developed but which would be necessary to get a more complete picture of progress.

A monitoring report based on the indicators is now produced biennially (Eurostat 2005, 2007a).

Main features

The framework is closely linked with policy priorities of the renewed strategy and includes 10 themes:

(a) Socio-economic development;

(b) Sustainable consumption and production;

(c) Social inclusion;

(d) Demographic changes;

(e) Public health;

(f) Climate change and energy;

(g) Sustainable transport;

(h) Natural resources;

(i) Global partnership;

(j) Good governance.

The structure of the set is configured as a three-storey pyramid, with the distinction between the three levels being symmetric to the structure of the Strategy (overall objectives, operational objectives, actions) and responding to various user needs.

Headline indicators

There are 12 Headline (or level-1) indicators:

(a) GDP *per capita*;

(b) Resource productivity;

(c) At-risk-of-poverty rate;

(d) Employment rate of older workers;

(e) Healthy life-years (and life expectancy);

(f) Total greenhouse gas emissions;

(g) Share of renewables in gross inland energy consumption;
(h) Energy consumption of transport;

(i) Common bird index;

(j) Fish catches from stocks outside safe biological limits;

(k) Official development assistance;

(l) Undefined measure of good governance.

United Kingdom

In 1994, the United Kingdom became one of the first countries to produce a sustainable development strategy (United Kingdom, 1994). The strategy led the Government to pursue, via an inter-departmental working group, a set of indicators with which to monitor progress. In 1996, a preliminary set of indicators was published (United Kingdom, 1996), making the United Kingdom one of the first countries to do so. This included some 120 indicators produced for discussion and consultation. The indicators were based on a unique framework using the key issues and objectives set out in the sustainable development strategy.

Following a change of Government in 1997, a new strategy, A Better Quality of Life (United Kingdom, 1999b), was published in 1999. The establishment of indicators was an integral part of the development of the new strategy, with work on indicators going alongside and sometimes ahead of discussions on the content of the strategy. A public consultation paper, Sustainability Counts (United Kingdom, 1998) proposed a set of 13 headline indicators covering economic growth, social investment, employment, health, education and training, housing quality, climate change, air pollution, transport, water quality, wildlife, land use and waste. The concept of a "headline" set received wide support. Responses to the consultation resulted in a fourteenth indicator on crime being included in the strategy document, and a fifteenth indicator on poverty and social exclusion was introduced in the final publication of the indicators. Some six months after the publication of the strategy document, Quality of Life Counts (Department of the Environment, Transport and the Regions, 1999b) was published. This provided a baseline assessment of the 15 headline indicators and 132 core sustainable development indicators, established to focus on specific issues and identify areas for action. Thereafter the headline indicators were reported annually (United Kingdom 2000, 2001, 2002, 2003, 2004a) in formal government reports. The headline indicators were also reported on a leaflet, which later inspired the European Commission, Eurostat and some other countries to produce indicator leaflets as part of their reporting.

The 1999 strategy document included a commitment to review the strategy and its supporting indicators after five years and in 2004 a public consultation was undertaken (United Kingdom 2004b).

A new United Kingdom Government sustainable development strategy Securing the Future (United Kingdom, 2005a) and the United Kingdom's shared framework for sustainable development One Future Different Paths were published in 2005. The strategy outlined a new set of 68 sustainable development indicators.

As well as a desire for a smaller number of indicators, the number finally included in the set was in part dictated by the intended reporting – a pocket-sized book. The first indicator report Sustainable Development *Indicators in Your Pocket* (United Kingdom, 2005b) was published as a baseline a few months later. Since then the indicators have been updated and published annually (United Kingdom 2006 and 2007).

Main features

The current indicators in the United Kingdom support four priority areas identified in the strategy:

(a) Sustainable consumption and production;

(b) Climate change and energy;

(c) Natural resource protection and enhancing the environment;

(d) Creating sustainable communities and a fairer world.

A number of the indicators support more than one priority area.

The indicators are reported with assessments of change compared to long- and medium-term baselines, and these assessments are summarised for each priority area and overall.

A number of indicators were not immediately available for publication in 2005, but were highlighted to be developed – most notably some new measures of well-being have now been integrated into the set.

Headline indicators

Having used a set of headline indicators since 1999, the new set of indicators is perhaps surprisingly less formal in reporting on a headline set. This is in part because of concern that there was too much focus on the headline set and that the broad headline indicators were of limited use for policy making. It was felt that regular reporting should encompass all the indicators, rather than just the headline set – with a smaller number of indicators this was considered more practicable than previously.

However, within the set there are 20 "United Kingdom Framework Indicators" which reflect the broad priorities shared by the United Kingdom Government and the administrations in Scotland, Wales and Northern Ireland. These broadly take on the role of "headline indicators." They are:

(a) Greenhouse gas emissions;

(b) Resource use;

(c) Waste;

(d) Bird populations;

(e) Fish stocks;

(f) Ecological impacts of air pollution;

(g) River quality;

(h) Economic growth;

(i) Active community participation;

(j) Crime;

(k) Employment;

(l) Workless households;

(m) Childhood poverty;

(n) Pensioner poverty;

(o) Education;

(p) Health inequality;

(q) Mobility;

(r) Social justice;

(s) Environmental equality;

(t) Well-being.

Switzerland

The Swiss Monitoring System for Sustainable Development (MONET[10]) differs from many other national and international systems as it does not evaluate a sustainable development strategy but monitors whether or not and in which areas Switzerland is on the road to sustainable development.

The notion of sustainable development was enshrined in the Swiss Federal Constitution of 1999 and made a federal policy goal in the Swiss Federal Council's Sustainable Development Strategy 2002.

In 2000, the Swiss Federal Statistical Office, the Swiss Agency for the Environment, Forests and Landscape and the Swiss Federal Office for Spatial Development launched the MONET project with the aim of setting up a sustainable development indicator system. The basis for the project was the outcome of a pilot study (FSO/FOEN 2000) on the United Nations Commission for Sustainable

[10] A German acronym for “Monitoring Sustainable Development.”

Development set of indicators carried out in 1999 and followed by a large consultation among experts and stakeholders.

Using a participative and iterative procedure involving 25 stakeholders and more than 80 specialists of the federal administration, a system of 135 feasible indicators (and 28 to-be-developed ones) was established and published in an indicator report from 2003 (FSO/FOEN/ARE 2004b).

In 2005 seventeen key indicators (FSO/FOEN/ARE 2005) were outlined as a subset of the system to focus on four key questions:

(a) Meeting needs – how well do we live?
Health: Healthy life years
Income: Household income
Physical safety: Violent crime
Unemployment: Unemployment rate;

(b) Fairness – how well are resources distributed?
Poverty: People living below the poverty line
Assistance to other countries: Official Development Assistance
Equality: Wage gap between men and women;

(c) Preservation of resources – what are we leaving behind for our children?
Teenage reading skills: Reading skills of 15-years old
Public debt: Level of public debt
Investment: Investment to GDP ratio
Innovation and technology: Human resources in science and technology
Biodiversity: Breeding bird population
Developed land: Developed land *per capita*;

(d) Decoupling – how efficiently are we using our natural resources?
Freight transport: Intensity of freight transport
Passenger transport: Breakdown of passenger transport
Fuel consumption: Consumption of hydrocarbon fuels and combustibles
Consumption of raw materials: Material intensity.

Another subset of 68 indicators feeds the dashboard, an internet tool developed in 2007. It illustrates each of the main postulates to create and maintain a sustainable society and gives an impression of where the country is headed.

The 2002 Sustainable Development Strategy's plan of action called for a general monitoring system based on indicators to be defined and updated on a regular basis. The 2008 strategy is set to expand the monitoring system's scope, making use of around 30 indicators to evaluate the strategy's key challenges.

Main features

The monitoring system features a frame of reference for the operationalisation of sustainable development and a systematic framework for indicator selection (FSO/FOEN/ARE 2004a):

"(a) On the basis of the definition of sustainable development used in the Brundtland Report and in line with recognised Bellagio Principles for indicator selection (International Institute for Sustainable Development, 1997) 45 postulates were drawn up, which indicate the direction to be taken in order to create and maintain a sustainable society. These cover the three target areas of social solidarity, economic efficiency and ecological responsibility. Whether or not the country is on the road to sustainable development is determined by comparing the observed trends with the postulates."

The framework brings forward a unique indicator typology model that is based on a stock-flow approach, but goes beyond this in order to reflect the complexity of the topic and to shed light on various aspects of issues (*e.g.*, inter- and inter-generational concerns). The five types of indicators are:

(a) The extent to which needs are met (level indicators);

(b) The status and potential with regard to resources (capital indicators);

(c) The use of capital (input/output indicators);

(d) Efficiency and distributional disparities (structural criteria); and

(e) Measures taken (response indicators).

The five indicator types form a grid with 26 themes (or policy areas), which is then populated with indicators.

Chapter III: THE CAPITAL APPROACH TO SUSTAINABLE DEVELOPMENT: THEORY

Within the international community, there have for a long time been discussions on how to complement and extend the traditional national accounts to better reflect the importance of the environment and society. Some industrialised countries took the lead on the environmental part of this in the 1990s and organised the so-called London Group on Environmental Accounting.[11] One result of their efforts so far is the United Nations handbook System for Environmental and Economic Accounts (United Nations et al., 2003), commonly referred to as the SEEA.

Though the SEEA was not conceived primarily as a framework for measuring sustainable development, the handbook notes this as one 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 (United Nations et al., 2003, p. 4):

> "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."

The rationale for this definition can be found in economic development theory. Given the importance of this theory to an understanding of the capital approach to sustainable development, the next section devotes considerable space to its presentation.

A. The role of capital in sustainable development

Classical development theory is strongly focused on investment and capital as central determining factors for development. While traditionally restricted to understanding economic development through expansion of markets and increases in human-made capital, the theory is increasingly extended and broadened so that it speaks to the broader question of how to secure sustainable development as well.

In the quote above from the SEEA, sustainable development is defined as non-declining *per capita* wealth over time. This definition concords well with that given in Chapter I but is more nuanced. In particular, the notion above states directly the need to maintain wealth as the basis of sustainable development, by-passing any mention of well-being. From the discussion of Samuelson's ideas in Chapter I, it will be recalled that wealth and well-being are very similar concepts. Thus, the SEEA definition above is simply a more technically precise way of saying that well-being is the basis of sustainable development.

The second nuance introduced above is that it is wealth *per capita* that matters and not just total wealth of the society. This reflects the fact that populations increase over time and that the rate of increase of wealth must be at least equal to population growth if sustainable development is to be achieved.

[11] See: http://millenniumindicators.un.org/unsd/envaccounting/londongroup/default.asp

The final nuance introduced above is to explicitly connect wealth and capital stocks. In Chapter I, the more general term "resources" was used. In this chapter, where the objective is to lay out the capital approach in detail, the more formal term capital will be used. On occasion, the term "asset" will also be used and it should be understood as an individual element of a capital stock.

The idea that the well-being, or wealth as it will mainly be referred to in this chapter, provides a robust platform for measuring sustainable development was also introduced in Chapter I. It was noted that the concept must be understood in its broadest sense, including the well-being derived from the consumption of all types of goods and services. All goods and services can be viewed as being produced through the use of capital, normally in conjunction with human labour. Since the concept of sustainable development demands that a very broad view of consumption be taken, then it is necessary to take an equally broad view of capital.

From this broad view, a society's total capital base is seen to comprise five[12] individual stocks: financial capital like stocks, bonds and currency deposits; produced capital like machinery, buildings, telecommunications and other types of infrastructure; natural capital in the form of natural resources, land and ecosystems providing services like waste absorption; human capital in the form of an educated and healthy workforce; and, finally, social capital in the form of functioning social networks and institutions.

Not all these forms of capital are equally well understood, either conceptually or empirically. The order in which they have just been presented in fact reflects the degree to which they are understood. Social capital, the least well studied of the five, remains a controversial concept for which no single definition is universally accepted.

Some argue that capital is perhaps not the most appropriate term for talking broadly about the resource base of a nation (Czesany, 2007). Given its history of narrower use in economics, its broad use in this report may be misleading. Some forms of capital, particularly human and social, cannot be treated in complete analogy with financial or fixed capital. Human capital, it is noted, is what used to be called human potential or human resources, while social capital resembles the notion of social cohesion or social institutions.

While concerns about dissimilarities among the various types of capital are legitimate, there are several reasons why the broad concept is nonetheless useful for measuring sustainable development. Firstly, it offers a basis for the important insight that development is not entirely stochastic or random but can be managed through investments in specific stocks. Furthermore, it provides a framework that explains why spending income on investments rather than current consumption is likely to enhance well-being in the future.

It must be understood at this point that managing total national wealth in a manner that sustains it over time, measured *per capita*, only provides the potential for sustainable development.

[12] A small, but important, category has been left out here for the sake of simplicity. It is that referred to by national accounts as intangible non-produced non-financial capital and it includes assets such as patents, leases and other transferable contacts; the rights to extract natural resources are included in this category, for example. The complete asset classification of the *1993 System of National Accounts* can be found at: http://unstats.un.org/unsd/sna1993/tables/table_Annex_13_.pdf.

This is because there is no guarantee that future generations will manage well the capital base they inherit. They may fail in utilising it effectively to create well-being and instead waste the resources on wars or on excessively "high living" without concern for the well-being of their descendants.

While stable or growing total wealth *per capita* is no guarantee of sustainable development, the opposite is a guarantee of its impossibility. That is, in the face of declining *per capita* capital stocks, well-being will in the long run deteriorate and sustainable development will not be possible (Hamilton and Ruta, 2006).

It can be argued that distributional or equity issues related to today's generation (*e.g.* intra-generational issues) should be included separately at this point as these are seemingly not easily captured by the capital approach. Social capital is, however, strongly influenced by the current degree of fairness in the distribution of resources. After all, social well-being 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 and who have control of the assets. 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 or justice thus relates to social capital.

Theories of economic development

The explanation of the role of capital in sustainable development draws many parallels with 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 thinking of Smith (1776) in the eighteenth century. He recognised savings and investment as keys to economic development. Without saving, there is no surplus from which investments can be drawn for maintaining or enhancing the capital stock. Probably the first systematic and rigorous treatment of this topic is found in Ramsey (1928).

Nobel Prize winner Robert Solow revived interest in classical growth theory in the 1950s, summing up his work on neoclassical growth theory in Growth Theory: An Exposition, in which he formalised production functions, or growth equations, explaining the forces driving economic development (Solow, 1988).

The notion of human capital was introduced by T.W. Schultze and Gary Becker in the 1960s (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 (OECD, 2003) documents empirically through regression analysis and other methods the importance of education and human capital for economic development. The state of art in this field was summarized in a paper by Greaker (2007) written as a contribution to Working Group's discussion.

The role of natural capital in development has been intuitively understood for a long time. Land figured prominently as a factor of production in Ricardo's works in the 19th century. In neoclassical development theory it was (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.

Box 1

Accounting prices

Accounting prices reflect, in theory, the scarcity of capital and the degree of substitutability among the various types of capital. The accounting price of a fishing boat (produced capital) will reflect the fact that the boat is not worth much without fish in the sea (part of natural capital). The accounting price of protected land will reflect the amount of well-being an additional unit of land set aside from development will provide. If development infringes on protected areas, their accounting price will increase, giving a clear signal that it might be well-being enhancing to invest in more protected areas compared to other types of investment or consumption. Thus, a lot of information of importance to sustainable development is conveyed by the accounting prices. They are, however, abstract and not directly measurable in practice. They may be closely approximated, though, by market prices when markets are undistorted.

At least since the publication of *The Limits to Growth* (Meadows et al., 1972), economists have explored – *inter alia* – the threat to development posed by the depletion of natural resources below critical levels (Dasgupta and Heal, 1979; Dasgupta, 1982; Baumol and Oates, 1975; Oates, 1992; Dorfman and Dorfman, 1977). Solow (1986) showed formally that Hartwick's rule for investing resource rents implies the maintenance of total national wealth or "some appropriately defined stock of capital…" at a constant level over time. In brief, Hartwick's rules state that for a broad class of neoclassical growth models in which natural capital contributes to the production of marketed goods and/or provides environmental amenities, the economy will maintain a constant or increasing level of *per capita* well-being only if investments in other forms of capital exceed the monetary value of natural capital depletion on an economy-wide basis (Howarth, 2007).

Measuring total national wealth

A nation's broad capital base is termed its total national wealth. Care should be taken not to confuse this concept with the more traditional notion from national accounting of national wealth, which refers only to the monetary value of the fixed assets in an economy.

Total national wealth should be understood to include all types of capital giving rise to consumption possibilities, or well-being, including tangible as well as intangible capital. It is the effect on well-being of a particular type of capital that gives it value. The value of an extra unit of capital – its *marginal* value – is what is called the accounting price of that particular type of capital (Dasgupta, 2001). Accounting prices are abstract concepts that take into account, in theory, all well-being effects associated with a given capital type (see Box 1 for further details).

Recalling the five categories of capital listed above, the total national wealth may be partitioned into financial, produced, natural, human and social capital components.

Put in symbolic terms we thus have:

$$TNW = p_F F^* + p_R R + p_N N + p_H H + p_S S$$

where *TNW* denotes total national wealth, *F*, R, N, H* and *S* are financial, produced, natural, human and social capital, respectively, and the *p*'s are associated theoretical *accounting prices* defined as the well-being effects of marginal changes in the corresponding types of capital.

Financial capital is denoted F* to reflect the fact that not all financial assets existing in a country count towards its national wealth. At the level of the whole economy, most financial assets drop out of the accounting because for every asset there exists somewhere else a liability of an exactly offsetting size. For example, the value of a share to a shareholder is exactly offset by the liability the share represents to the issuing company. Only the net financial position of the citizens of a country with respect to the rest of the world – that is, the difference between foreign assets and liabilities – counts in its national wealth. Of course, at the global level these cancel out too, so that global wealth has no financial component. Because financial capital figures in a relatively limited way in national wealth, it is not treated in great detail in this report.

From a purely conceptual viewpoint, TNW *per capita* is an ideal sustainable development indicator (Hamilton and Clemens, 1999; Dasgupta and Mäler, 2000; Dasgupta 2001). This is not surprising given the theoretically "perfect" accounting prices that lie behind it. When measured over time TNW will, by definition, provide an ideal indicator of the trend in social well-being.

While ideal in theory, TNW cannot achieve its full potential as a practical indicator of sustainable development because accounting prices are never directly observable and can only be approximated imperfectly in real-world analysis. Fortunately, economic theory tells us that, under certain (stringent) conditions, observed market prices are fair estimates of accounting prices. That is, market prices of a number of assets reflect their well-being effects. This includes cases where the assets are, *inter alia*, bought and sold in free markets where full information is available to all players, where no single player has undue market power, where the external effects of the assets are negligible. While these conditions seldom are perfectly fulfilled, market prices probably serve as good estimates of accounting prices in cases where the assets in question are frequently and openly traded. This point is discussed further in Chapter IV.

Summary

In the reasoning above, the challenge of sustainable development has been simplified into a question of whether a country's total capital base – or total national wealth – is managed in a way that secures its maintenance over time. Thus simplified, the focus of the sustainable development challenge is sharpened and put into concrete terms. The question whether financial, produced, natural, human and social capital stocks *per capita* are increasing or declining over time is one that lends itself to a precise answer. Furthermore, this focus helps make sense of the inevitable tradeoffs that must be weighed as development proceeds. For example, if one capital stock – let us say, petroleum wealth – declines, the framework allows us to ask whether it is being offset by growth of another stock, human capital perhaps. This last question touches on a difficult point of whether, and

to what extent, the various capital stocks can be expected to substitute for each other as far as well-being effects are concerned. This question is further discussed after more detailed descriptions are given of the various types of capital that constitute total national wealth.

B. The categories of capital

A taxonomy of the benefits associated with capital stocks is depicted in Table 4. Private economic benefits (quadrant I) are measurable by observed market prices. Public economic benefits, or costs, (quadrant II) are external effects where persons not directly involved in a transaction benefit (or lose) as result of the use of capital in a market transaction. These are not measurable by direct market prices, but may be estimated by indirect methods. The wider social benefits of capital are those stemming from use of capital stocks outside markets. These benefits can be private (quadrant III) or public (quadrant IV). The taxonomy can be explained by considering the benefits associated with use of a privately owned forest.

Timber extracted from the forest by its owner represents a private economic benefit. If the forest provides flood control that controls erosion on surrounding farmland, this is a public economic benefit. The wider social benefits to the owner and the general public could include the provision of nice scenery or the pleasure of knowing that plants and animals find habitat in the forest.

All categories of capital can provide all of these benefits, though to a greater or lesser degree depending on the type. Thus, benefits from produced capital will probably reside mainly in quadrant I, while social capital perhaps provides mostly benefits of type IV.

Table 4. Taxonomy of capital benefits

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

Financial capital

Financial capital is defined formally to include any asset for which a counterpart liability exists somewhere on the part of another institutional unit.[13] These include currency and other forms of bank deposits, stocks and bonds, derivatives, accounts receivable, pension funds and insurance reserves.

The value of financial capital is recorded in the balance sheet accounts of the national accounts.

[13] Gold reserves are also considered financial assets, though they have no corresponding liability.

Produced capital

Produced capital includes fixed assets that are used repeatedly or continuously in production processes for more than one year. Fixed assets can be tangible – such as machinery, buildings, roads, harbours and airports – and intangible – such as computer software, original works of artistic value (recordings, manuscripts) and other specialized knowledge used in production. Inventories of raw materials, semi-finished and finished goods held for future sale are also included in produced capital, as are valuables such as precious stones, antiques and paintings.

The value of produced capital is recorded in the balance sheet accounts of the national accounts.

It is a common assumption that observed market prices for produced and financial capital are fair reflections of their well-being effects. In other words, market prices come close to the theoretical ideal of accounting prices for produced and financial capital. In practice, however, the reported numbers are not always certain.

Natural capital[14]

Natural capital refers to the earth's natural resources, land and the ecological systems that provide goods and services necessary for the economy, 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."

This broad category covers both non-renewable natural resources like land, coal, oil and gas, minerals, sand and gravel etc. and conditionally renewable resources like forests, fish and waterfalls used for hydro power production. For the most part, these are all resources that are bought and sold on markets and their valuation in monetary terms is therefore a relatively straightforward exercise.

In addition, natural capital covers ecosystems and other natural systems that provide various essential services to mankind. Borrowing the classification scheme used in the United Nations Millennium Ecosystem Assessment (2005), ecosystem services may be divided into provisioning, regulating and cultural services (Figure 1).

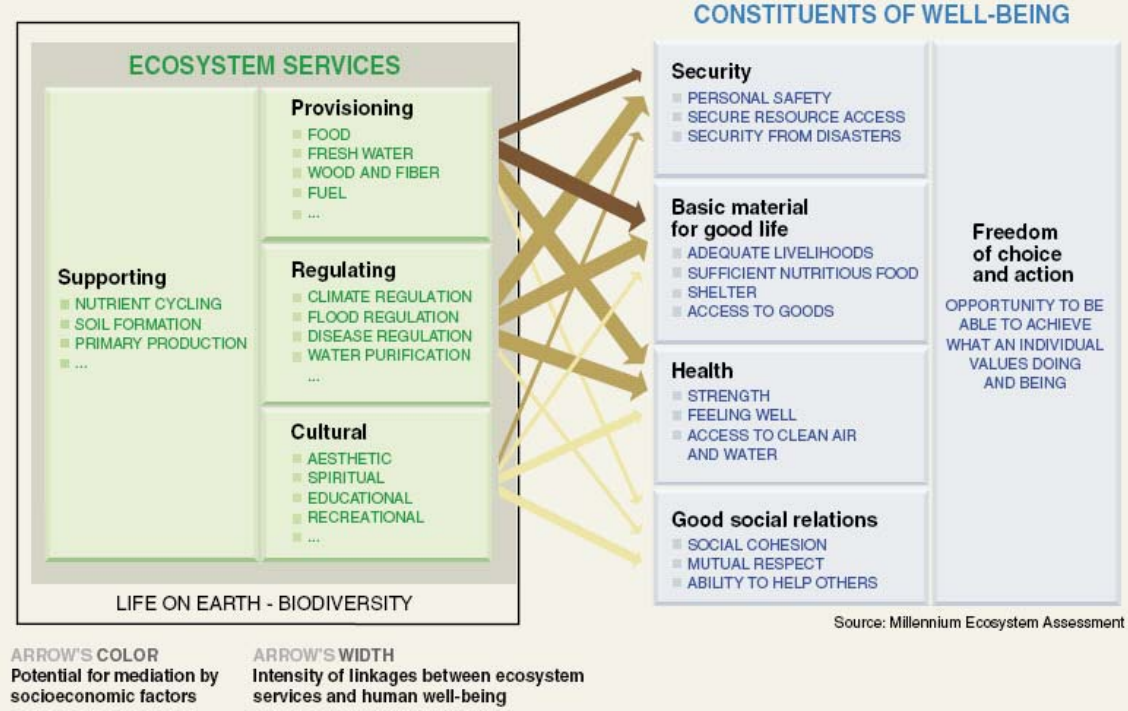
Material resources like minerals, timber, fish, and water belong to the provisioning category. The regulating category covers services like absorption of unwanted wastes from production and

[14] Note that some natural capital, as it is defined here, is treated as "non-financial non-produced tangible capital" in the *1993 System of National Accounts*. In particular, land, subsoil natural resources, timber, fisheries and water are all considered assets in the *System of National Accounts* to the extent that ownership rights may be enforced over them and that they may be used profitably in a production process under current conditions of technology, price, access and knowledge.

consumption and regulation of the global climate. Cultural services are sometimes called amenity functions and are relevant to humans only.

Figure 1 depicts the strength of the linkages between various ecosystem services and different elements of human well-being and indicates the extent to which socioeconomic factors can mediate the linkages. 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, of course, in different ecosystems and regions.

Figure 1. Classification of ecosystem services



Source: Millennium Ecosystem Assessment (2005)

The value of some environmental services is captured in the value of other assets. Beachfront property, for example, is expensive in part because of the service provided by a beautiful view. Hotels and lodges capitalize some of the value of their natural surroundings. Farmland values capitalize the value of pollination services provided by insects. Natural assimilation of pollutants means that pollution controls do not need to be as stringent (and costly) as they would otherwise be.

What cannot be captured in the value of other assets are any ecosystem service values that manifest themselves outside the market; for example, the pure option or existence value that people may place on some ecosystems. The value of these kinds of services is often extremely difficult to estimate and, for this and other reasons, is seldom captured in monetary measures.

The problems of valuing natural capital are as varied as the resources themselves. For most traditional natural resources (minerals, fossil fuels, timber, etc.), market prices exist, though they seldom reflect negative externalities resulting from exploitation of the resources. For instance, timber extraction often comes at the expense of biodiversity preservation, soil protection and other environmental services provided by the same trees that give us timber. To arrive at an approximation of the accounting price of forest capital, market prices will have to be corrected for these kinds of negative externalities. Since ecosystem services are not usually priced in the market, special methods must be employed to make these corrections. In a fair number of cases it is difficult to find reliable and objective accounting prices. Overall it is fair to say that monetary accounting for natural capital is not yet operational in the same way as for produced and financial capital.[15] In view of these difficulties, physical measures of natural capital must be sought as part of any suite of capital-based sustainable development indicators. This topic is treated in detail in Chapter IV.

Human capital

Human capital does not yet have just a single definition. 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 it 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 well-being aspect. It is interesting to note that the process of creating human capital can be, at once, both consumption and investment. This is reflected in the fact that we enjoy the process of learning in and of itself and also because it better equips us to engage in life.

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) was the standard reference for many years[16].

Today, the economic importance of knowledge and skills is widely recognised both within labour economics, growth theory and business economics. At the same time, many see the personal and social well-being effects of learning as being as important as the economic ones.

Private economic benefits are at the core of the original human capital theory (quadrant I in Table 4). 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 the International Adult Literacy Survey (OECD and Statistics Canada, 2000) show that education, literacy, experience, parent's education and the use of mother tongue account for between 20 to 50 percent of the total variations in the labour market earnings.

[15] See Vemuri and Costanza (2006) for a brave effort in measuring the impact of various types of capital on social welfare.
[16] 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.

In addition to the benefits captured by individuals, investment in human capital may yield benefits to the economy at large (Table 4). The collective economic impact should, 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 point acceleration in growth with respect to the previous decade" (OECD and Statistics Canada, 2000).

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). Such conclusions are, nevertheless, inevitably questioned. For instance, Korea has seen a dramatic increase in the educational attainment of its labour force. Yet this has not translated into an equally dramatic effect on the growth rate of the economy, at least not yet. 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.

In addition, there is a wide range of non-market 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:

(a) Better health;

(b) Lower crime and delinquency rates;

(c) Higher civic participation, volunteering and charity giving;

(d) Promotion of education to next generation; and

(e) Higher rates of self-reported happiness.

Social capital

The notion of social capital is the most recent addition to the capital approach. As social capital has its origins in sociology, the focus has been identifying the positive elements of society to be conserved and further developed. This has led to a number of theoretical approaches for conceptualising social capital being proposed. These are highly overlapping, and range from the distribution of basic goods, to the maintenance of social peace, to social protection and constitutional goals, to networks and associated norms.

Although there has been a considerable amount of research and attention devoted to social capital in recent years, there remains a lack of agreement around a precise definition of the concept (see Box 2). However, there is a growing consensus around the idea that it is social networks and their associated norms that generate benefits. The most commonly adopted definition in this conceptualisation of social capital is the OECD definition: "networks, together with shared norms, values and understandings which facilitate co-operation within or among groups" (OECD, 2001).

Box 2
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)
"….the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions."(World Bank, 2000)
"….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)

Like other forms of capital, social capital generates benefits that improve well-being. The benefits can be grouped into those associated with institutions and those associated with culture. The former include the rule of law and administration of justice, universal suffrage, transparency of political processes and international conventions and agreements. The latter include language, religion, sports and, arguably, fashion.

Social capital, defined in terms of networks, was described independently by sociologists Pierre Bourdieu and James Coleman in the 1980s. Bourdieu (1986) defined social capital as an individual asset, focusing on the benefits accruing to individuals by virtue of participation in groups. Coleman (1988 and 1990) focused on the more collective characteristics of networks, emphasising social capital as the collective benefit derived from social interaction.

Although social capital has its roots in sociology, it has also become an important topic for economists and political scientists (Putnam, 1983 and 1995; Fukuyama, 1995). In the late 1990s, the concept became more reputable than previously, with the World Bank devoting a research programme to it and a successful book by the political scientist Robert Putnam Bowling Alone (2000), which traced the decline of group membership in the United States.

In thinking about social capital, the following simple model can be asserted. There are sources, assets and outcomes associated with social capital. The sources are individuals, groups and institutions. The assets are the networks and associated norms, such as shared understandings and informal rules that influence behaviour. Networks link individuals, groups and institutions. They occur in a variety of different modes and forums, including face-to face meetings, legislation and technology-assisted transmission of information. The outcomes are the positive and negative effects that come from social capital and can include identity and sense of belonging, increased knowledge and understanding, community resilience, lowering of transaction costs, conflict resolution, social exclusion or intolerance of difference, reduced family functioning and corruption.

It is widely considered that social networks serve an important purpose in generating well-being. The creation of social networks may have a direct well-being effect as individuals who are strongly embedded in societal networks tend to be happier and more satisfied with life than those who are less well integrated in society. Also, social capital may increase the value of other types of capital; for example, social networks can aid in the search for a new job and, in so doing, help build human capital. The stimulation of innovation when there are strong knowledge networks may increase the value of produced capital. The effects of network externalities such as trust may lead to general increases in efficiency and a decline in transaction costs. Generalised trust and the creation of commonly shared norms result in informal checks on behaviour which are far less costly than formally institutionalised transactions based on contracts, formal sanctions and legal systems.

Social network analysis is not a recent arrival in the sphere of sociology or other disciplines. The composition, density and connectedness of various networks are thought to constitute important characteristics of social interaction with implications for society at large (Granovetter, 1973). In fact, network analysis is an area of research well rooted in theory and uses research techniques and measurement tools that have proven particularly useful in the study of social capital (Franke, 2005). More is said on this point in Chapter VI.

C. Limitations to the ideal capital framework

The capital framework has been introduced in theoretically ideal terms without much attention to its shortcomings so far in this chapter. Several limitations of varying degree of seriousness merit discussion, some conceptual and others practical. The most serious are those that limit the extent to which monetary values can be placed on capital stocks. The discussion starts with these.

Limitations on valuation

The value of capital resides in its potential for creating well-being, either directly, as in a "walk in the woods," or indirectly through the use of the capital as an input in a production process. There is no natural unit of measure with which to express this value. Accounting prices, if they could be measured precisely, would not be denoted in currency units but in units of pure "utility." These are sometimes referred in the economic literature as "utils." Though a useful theoretical construct, "utils" offer little by way of a practical aid for measuring the value of capital stocks in the real world.

The fact that market prices for capital assets in some instances come close to theoretically ideal accounting prices has already been noted. Since market prices are denoted in currency units ("dollars" from here on for the sake of simplicity), then it is reasonable that dollars would be seen as a practical unit for measuring capital stocks in general. Using dollars has the advantage of putting capital stock measures on an equal footing with other measures of market activity, like gross domestic product. If all capital stocks could be measured in dollars, there would be the added advantage of comparability among the various types of capital. The value of produced capital could be compared directly with, for example, the value of social capital to assess which makes the greater contribution to well-being.

If substitution possibilities among capital types are high[17] and the value of each capital stock is measurable in dollars, a very robust and intuitive indicator of sustainable development would be change in total national wealth *per capita*. This quantity, often denoted genuine investment or genuine savings (Dasgupta and Mäler, 2000; Hamilton and Clemens, 1999), can be shown to be an ideal measure of the potential for future social well-being under certain conditions. Positive genuine savings indicates that social welfare is increasing, a good thing in and of itself, but not strictly equivalent to sustainable development because of the possibility that future generations will squander their inheritance. Negative genuine savings, on the other hand, indicate unequivocally that social welfare is falling and, by implication, that the development path is not sustainable. Given the power of genuine saving as a measure of sustainable development, a clear recommendation is that, whenever feasible, capital assets should be valued in monetary terms.[18]

Box 3

Conditions in an ideal market

Atomicity: An atomic market is one in which there are a large number of producers and consumers, each so small that its actions have no significant impact on others. Producers are price takers, meaning that the market sets the price that they must choose.

Homogeneity: Goods and services are perfect substitutes; that is, there is no product differentiation.

Perfect and complete information: All producers and consumers know the prices set by all producers.

Equal access: All producers have access to production technologies and capital and labour are perfectly mobile.

Free entry: Any producer may enter or exit the market as it wishes.

Individual producers and consumers act independently: There is no scope for groups of producers and/or consumers to collude with a view to influencing prices.

If the desirability of measuring all capital stocks using dollars as a common unit of measure is obvious, actually doing so is, unfortunately, not always. This is so for two reasons. Firstly, it is difficult to uniquely determine all of the ways in which capital contributes to well-being. Those that cannot be identified obviously cannot be valued. Secondly, even for those contributions that can be identified, it is sometimes difficult to translate their value into dollars. This is partly because functioning markets rarely achieve the ideal conditions economists impose upon them in their valuation methods (see Box 3). The question is, then, to what extent the deviations from these conditions distort observed market prices so much as to make them inappropriate for valuing assets. It is a question to which economists have regularly turned themselves and it is fair to say that it remains actively debated. Certainly, there is a strong current of work devoted to valuation of assets by both micro- and macro-economists (Atkinson et al., 1997; Champ et al., 2003; Freeman, 1993; Pearce et al., 2006). Not all economists believe such

[17] In technical terms, the elasticity of substitution should be unity or higher. If this elasticity is less than unity (notionally, it is impossible to perfectly substitute one asset for another) and some assets and essential for production, then sustainable development is impossible without an appropriate rate of technological change to supplement the productivity of the economy.

[18] This is also in accordance with the recommendation from the National Research Council of the National Academies in the United States (Abraham and Mackie, 2005).

valuation is feasible, however. The 2000 winner of the Nobel Prize for Economics, Daniel McFadden, is one such critic (McFadden, 1996).

In addition to the debate over the economics of valuation, there is a debate over its ethical underpinnings. Certain observers place a question mark after the right of humans to exploit nature in a destructive manner, even if this, at least in the short run, may increase total national wealth. For some – perhaps many – people, nature has an intrinsic value outside its contribution to human well-being. Clearly, aggregating nature along with other forms of wealth as though humans are indifferent to its existence so long as their well-being is otherwise assured is at ethical odds with this view.

Critical capital

Genuine savings was noted above to be an ideal measure of sustainable development under certain conditions, one of which was a high degree of substitutability among capital types. Though the degree to which this condition holds in the real world is a matter of debate, it is generally accepted that the various components of national wealth cannot always and without difficulty be replaced with each other. It is not so, for instance, that ecosystem services, which may be considered as one of the dividends of natural capital, can easily and always be replaced by increased income, the dividend of financial, produced or human capital.

As an important example, consider a fundamental natural 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. Coming 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.

Similarly, we now know that biological diversity is a fundamental condition for the maintenance of many ecosystem services that benefit all. Without a minimum of biological diversity, the services of essential ecosystems may be significantly reduced with very adverse consequences for inter alia food production.

In the same way it could be argued that there is a critical level of social capital that is essential in order to maintain development in the long-term. The partial or complete destruction of social networks and their associated norms would significantly undermine the capacity of communities to meet both short-term and long-term needs. In order to meet broader long-term goals than human existence, society requires networks and associated norms which can support this. Social capital creates the environment within which a longer-term view can be sustained.

In an influential work on this issue, Pearce and Atkinson (1993) introduced more precision and rigour into the thinking around substitutability by defining the concepts of weak sustainability and strong sustainability.

Weak sustainability in their nomenclature is a normative sustainable development goal specifying that the total *per capita* value of all capital stocks, or total national wealth *per capita*, should not decline over time in real terms. Weak sustainability incorporates an assumption of

perfect substitutability between the various stocks of capital. The depletion of one stock of capital –petroleum reserves, say – can always be fully compensated by investment in another stock – perhaps human capital. So long as this compensation is always undertaken, then society is free to pursue whatever mix of capital stocks best suits its well-being without worrying about the sustainability of development. A strong undercurrent in this view is that technological progress will, over time, eliminate all constraints imposed by scarcity of any particular capital stock. It is, in other words, the world view of the technological optimist. The practical upshot of this view for the measurement of sustainable development is that a single monetary aggregate, such as genuine savings or total national wealth, is a sufficient measure of sustainable development.

Box 4

Climate systems: Complexity in natural capital

It is only with considerable uncertainty that we are able to predict the effects of climate change. Due to hysteresis effects in the climate system, like the thawing of permafrost and consequent release of large quantities of trapped methane – a strong greenhouse gas, there probably exist "tipping points" beyond which it will be very difficult to avoid significant global warming. The exact position of these tipping points is however not known.

According to 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."

Strong sustainability, on the other hand, assumes that substitution possibilities among capital stocks are limited, even in the face of technological progress, because of the critical nature of some services. It therefore demands that there be minimum levels below which stocks of critical capital not be allowed to fall.

The strong view is especially associated with concerns about natural capital.[19] It recognizes that the impact of humans on the environment is becoming less and less marginal. Small changes in natural capital, even critical natural capital, may be reasonably easily dealt with through substitution or simply by accepting lower levels of ecosystem services. As changes become greater, however, we move closer to the point where substitution is a practical impossibility and where living with reduced service levels induces unbearable costs. The well-being consequences of these non-marginal changes in natural capital are difficult to measure, in part because scientific knowledge of natural systems falls far short of perfect (see Box 4). Careful tracking of natural capital stocks is therefore called for by the strong view. As noted, though, arguments can be made that critical forms of capital can be found in other categories, including social capital. Thus, the strong view of sustainable development should not be viewed as relevant only to environmental concerns.

To the extent that some capital stocks are indeed critical, the possibility of using a single monetary aggregate to measure sustainable development disappears. It would be wrong to aggregate values for non-critical capital with those for critical capital into a single measure. In doing so, essential information for sustainable development would be lost.

[19] The environment was a particular concern for Pearce and Atkinson.

From the limitations discussed above, it should be evident that the challenge of measuring sustainable development from a capital perspective is more complex than theory would suggest. The valuation of human, natural and social capital assets – while a subject of increasing maturity – remains constrained by economic and scientific understanding, as well as by (for some) ethical considerations. And even if valuation presented no problem, aggregation of all capital types into a single indicator of national wealth would be questionable to the extent that some forms of capital are critical to sustainable development.

All of this suggests that a practical implementation of the capital framework cannot rest on a monetary indicator like total national wealth or genuine savings alone. Certainly, monetary indicators are desirable and should form part of any set of sustainable development indicators based on capital. Additionally, though, the approach requires separate indicators of critical capital stocks measured in physical units.[20] This and other issues associated with the practical implementation of the capital approach are taken up in the next chapter.

[20] The existence of critical capital is not, in theory, an absolute argument against using total national wealth as an indicator of sustainable development. This is because accounting prices are, in theory, able to take into consideration the non-substitutability of critical capita (Mäler, 2007). The practical problem remains, however, how to approximate accounting prices and whether these approximations adequately reflect all the well-being dimensions of capital, including the criticality of some forms. Until this problem is resolved, physical indicators of capital will be required to complement aggregate monetary indicators.

Chapter IV: IMPLEMENTING THE CAPITAL APPROACH IN PRACTICAL TERMS

In Chapter III, it was argued that an indicator of total national wealth is, in theory, an ideal indicator of sustainable development. It was also shown that it fails to live entirely up to its theoretical ideal for a number of reasons. These include imperfect markets, limitations on substitutability, critical capital, complexity and ethical concerns.

Confronted with a situation where the ideal is for practical reasons unreachable, the challenge is to find a set of indicators that draws upon the strengths of the capital approach while overcoming its practical difficulties. Defining such a set of indicators is the topic of this chapter.

A principal strength of the capital approach is the hope it offers to reduce the complexity of sustainable development by measuring the determinants of well-being in the common denominator of dollars. The simplicity of such a measure is a strong motivator for its development. A practical set of capital-based indicators should then include monetary indicators for those stocks that can be meaningfully valued using existing data and methods.

In addition to the monetary indicators, other indicators will have to be found for those capital stocks that cannot or should not be valued. These additional indicators, which should be as limited in number as possible, must be measured in whatever physical units of measure are suitable. Before discussing what these physical indicators should be, the possibilities for practical monetary indicators of sustainable development are explored.

A. Economic wealth – a practical monetary indicator

Many capital assets and/or the goods and services they provide are bought and sold in markets. There is good reason to argue that the market value assigned to these assets (or goods and services) is a close approximation of their contribution to well-being, at least insofar as well-being is a function of market consumption. In other words, there is good reason to argue that market prices for capital assets come close to theoretically ideal accounting prices. This applies to all financial and produced capital. It also applies to those elements of natural capital and related products that are commonly traded in the market; including, timber, fish, minerals and energy. It applies as well to the output of human capital (labour) insofar as it is used in the market. And it applies, in principle, to social capital, though there are no market prices at all for this sort of capital or for the services it provides.

In undertaking the buying and selling through which the price of these assets is established, it is reasonable to assume that economic agents behave rationally in general and attempt to maximize their well-being. Furthermore, in most countries it is reasonable to assume that the markets in these assets demonstrate to a considerable degree the elements of ideal markets outlined in the previous chapter. While these assumptions no doubt can be called into question in individual examples, the large number of transactions in assets will serve to eliminate extremes in valuation and force prices to convergence on something close to the theoretical ideal of accounting prices.

Using market prices as a guide, then, it is possible to estimate the contribution of a fair range of capital assets to what might be called the economic component of well-being. Given this,

extending the valuation of these assets as far as possible into an indicator of market-based economic wealth is an important task in a set of capital-based sustainable development indicators. To be precise, the correct form of the indicator is real (inflation-adjusted) per capita economic wealth. For the sake of simplicity, this is referred to below simply as economic wealth.

It is essential to make clear the distinction between the conceptually ideal indicator of total national wealth, incorporating a complete set of assets and based on theoretical accounting prices, and this practical indicator of economic wealth, incorporating only some assets and based on market prices. In particular, it must be recognized that benefits like good companionship or the pleasure of a wilderness experience derived from non-marketed assets are well beyond what is included in economic wealth.

Even though the practical economic wealth indicator only partially covers what properly belongs to total national wealth and although market prices are not perfect substitutes for accounting prices, an indicator of economic wealth clearly belongs to a set of indicators of sustainable development based on the capital approach.

Economic wealth is equal to the sum of the value of all assets that contribute to market production, including financial, produced, natural, human and social capital. They are called here economic assets. In practice, it is not possible to observe market values for all capital types directly, so calculating economic wealth by summing just observed values is not possible. Only in the cases of financial and produced capital are market values normally directly observable. Market values for natural capital are observable in some instances[21], but natural assets are generally not traded on markets. Well-established indirect methods based on universal principles of valuation can be used, however, to estimate natural capital values in the absence of market prices (Freeman, 1993). Human capital values are also not directly observable, but again indirect methods exist for valuing it (Greaker, 2007). Most problematic is social capital, where neither directly observed values nor well-established indirect methods exist.

Although economic wealth cannot be measured today by summing observed or estimated values for the five categories of capital, economic theory (Hamilton and Hartwick, 2005; World Bank, 2006) gives us another approach. According to this theory, economic wealth is also equal to the present value of future market income, where market income equals what is spent on market goods and services plus net investment in various types of capital. The World Bank (2006) has discussed this approach in detail and used it as the basis for estimating economic wealth in more than 100 countries.

Subtracting from economic wealth the value of those capital stocks that can be observed in the market plus those that can be estimated using indirect methods generally leaves a residual. This residual encompasses those forms of capital that contribute to economic wealth but cannot be measured directly, most importantly social capital. The residual also reflects all kinds of positive or negative externalities between capital, technology and labour with effects in the market; in

[21] For example, in some countries entire forest tracks are held privately and traded in open markets.

particular, it will pick up all the growth in income that cannot be explained by increased factor usage.

It should be noted that economic wealth calculated in the above fashion is sensitive to assumptions about future income and to the choice of discount rate. These assumptions must, of course, be made explicit in any use of this method in official statistics.

B. Completing the practical indicator set

While economic wealth is an important measure of sustainable development from the capital perspective, it cannot stand alone. Economic wealth measures only the capital base that contributes to market income. While market income is an important contributor to well-being, it is far from alone. Well-being is also created by "consuming" non-market flows of goods and services such as breathtaking scenery on a smog-free day, positive relations with one's loved ones and the personal capacity to pursue self-fulfilment. The non-economic assets that produce these flows must be measured both because they are important in and of themselves, but also to ensure that in the pursuit of market income the capital base from which non-market well-being is derived is not eroded. To the extent that this was the case, gains in market income would be misleading in isolation as an indicator of sustainable development.

In aggregating across different capital types, economic wealth makes rather strong assumptions about substitutability among them. If economic wealth 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 a high degree of substitutability between different forms of capital. While some forms of capital are highly substitutable at the margin, this mainly does not apply in the limit (that is, complete loss of a certain category of capital assets is nearly certain to lead to well-being losses) and it does not even apply at the margin for some, critical, forms of assets.

Since economic wealth cannot stand alone, it must be supplemented with additional indicators selected to reflect the well-being effects of capital that cannot or should not be captured in a market-based monetary measure. They must take into consideration the limited substitutability among different forms of capital, the existence of critical forms of capital and the fact that well-being is derived from more than market consumption. Finally, they must take into account the fact that it is not just stocks, but flows too that are important from a capital perspective. Flows are significant because they determine changes in stocks from one period to the next.

Additional stock indicators

The first necessary extension to the set of capital stock indicators is to complement the aggregate indicator of economic wealth with separate monetary indicators of financial capital, produced capital, human capital, natural capital and social capital. Extending the indicator set in this way takes care of the concern about the non-substitutability of capital stocks at the margin. As with

economic wealth, these separate monetary indicators should all be measured in real *per capita* terms.

Monetary measures of stocks of financial, produced, human and natural capital are all, to varying degrees, empirically feasible today. Such a measure is not yet feasible for social capital however. So, in practical terms, the most that is possible at the moment is to set aside a place holder for a monetary indicator of social capital.

Taken together, the six monetary indicators proposed so far (aggregate economic wealth plus individual measures for each of the five capital types) offer a robust, if not yet complete, picture of where the wealth of a region, a nation or even a sub-national jurisdiction comes from. They determine how much each type of capital contributes to well-being derived from market consumption and will indicate if there is mismanagement of any of them. Tracking them over time will help reveal whether development is proceeding along a path that will sustain long-term well-being or not.

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 be substituted even at the margin.

One category in which critical assets are found is natural capital, as here reside the assets that are essential for basic life support. 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) A reasonably stable and predictable climate;

(b) Air that is safe to breath;

(c) High-quality water in sufficient quantities; and

(d) Intact natural landscapes suitable for supporting a diversity of plant and animal life.

Some of the assets in this list can in fact be valued in monetary terms, although this remains a matter more for research than for official statistics. For now, practical indicators of critical natural capital must be measured in physical terms.

The practical indicator set should, then, be extended to include a physical indicator for each of the above categories of critical natural capital. As an indicator of climate stability, temperature deviation from historical norms is suitable (Epstein and McCarthy, 2004). For air quality, an indicator of ground-level ozone and fine particulate matter concentrations would be appropriate (World Health Organisation, 2006). For water quality/quantity, a quality-adjusted indicator of water availability would be appropriate (Hamilton and Whitfield, 2008; Schaefer and Bielak, 2005). For intact natural landscapes, a fragmentation index showing the degree of human disturbance in natural areas would serve as a suitable indicator (Dale and Beyeler, 2001).

It was noted in Chapter III that there may well be other forms of capital that also have critical elements, including social capital. It is not known yet what these might be, so only a place holder can be set aside within the indicator set at this time.

The final extension to the set of stock indicators is to account for the fact that some capital assets contribute to well-being outside of the market place. While this is not a concern for financial and produced capital, it is for natural, human and social capital.

Natural capital contributes to well-being outside the market mainly when humans experience nature directly (for example, when camping) or when they derive pleasure from the knowledge that nature continues to exist. In principle, the well-being associated with this use of natural capital can be valued in monetary terms. To the extent that this was 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 well-being of non-market enjoyment of nature. Physical indicators are therefore called for in practice in the vast majority of cases.

Since many of the same features of the environment that are critical to development are also those from which humans would derive non-market well-being, it is proposed that the same set of physical indicators listed above serve also as the indicators of non-market natural capital.

Human capital also contributes to well-being 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 well-being associated with human capital in monetary terms, in practice the scope for doing so is limited and 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 (Sharpe, 2001). Education achievement can be usefully measured with an indicator of the share of the population receiving post-secondary education. Health status can be measured with an indicator of health-adjusted life expectancy.

The last item that requires discussion is the contribution of social capital to non-market well-being. As with human and natural capital, perhaps more so, it seems reasonable to suggest that social capital makes a contribution to non-market well-being. And, as with its contribution to market well-being, the scope for valuing social capital's contribution to non-market well-being appears limited at this time.

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; pp. 31-32) suggest that the focus should be on three types of proxy indicators: membership in local associations and networks, trust and adherence to norms, and collective action (see Box 5). In the absence of direct indicators of social capital, these three proxy indicators can be included in the practical set as an initial step towards measuring social capital.

Flow indicators in a practical set

Though the central focus of the capital approach is asset stocks, the measurement of flows is also integral. To the extent that an asset changes in value or size over time, there must be identifiable flow that is the cause of the change. Indicators of these flows should be included in the practical set of sustainable development indicators. As with the stock indicators discussed above, flow indicators based on the capital approach require both monetary and physical measurement.

There are two central concepts when thinking about flows of capital. One is investment, which is the general term referring to any human-controlled flow that increases a capital stock. Normally investment is thought of in monetary terms, though there is a physical analogue to it in most cases. Both monetary and physical indicators of investment are therefore possible.

Box 5

Proxy indicators of social capital

Membership in local associations and networks: Numbers of associations and members in them along with qualitative measures of membership (such as internal heterogeneity) and institutional functioning (such as the extent of democratic decision making). Deciding which associations to count is society-dependent. Agrarian syndicates could be relevant in one society, rotating credit and savings associations in another and 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.

Trust and adherence to norms: Measures of the expectations and experiences regarding trust and adherence to norms (cognitive social capital) among the members of a society. Key questions relate to the extent to which households actually received or would expect to receive assistance from members of their community or network in the case of an emergency such as the loss of income or an illness.

Collective action: The extent to which collective action to provide services to members of a society occurs is a measure of underlying social cohesion so long as the co-operation is not imposed by an external force, such as the government.

The other central flow concept is depreciation, which is the general term referring to decreases of capital stock. Again, though depreciation is normally thought of in monetary terms, there is a usually a physical analogue.

Though investment and depreciation are the central flow concepts in the capital approach, they are not the only ones. Another important concept that applies to any stock measured in monetary terms is revaluation. This is the term used to describe changes in the value of a capital stock due to relative price changes. For example, if the world price for oil increases, then the value of an oil-rich nation's reserves will increase as a result even if their physical size remains the same.

Natural capital in particular, being an element of the natural world and therefore not under direct human control, requires specialized terms to describe the various flows that cause its increase or decrease. Depletion is the term used to describe a decline the value or size of a traditional natural

resource stock like a mineral. Degradation is used to describe a decline the value or size of ecosystem assets, especially a qualitative decline in ecosystem functioning. Depletion and degradation are really just synonyms for depreciation.

Discoveries is a term used in reference to natural capital that is similar, but not quite identical to investment. Discoveries describe the increase of natural capital stocks as a result of exploration and development activities, say by mining companies. Discoveries differ from investment in that they do not result in the creation of anything physically new, but simply the transfer of previously existing resources from the category of "unknown" to "known".

Consumption of natural capital is the opposite of discoveries. It describes the reduction in natural capital stocks as a result of withdrawal of resources for the purpose of supplying the economy with raw materials.

Having discussed the basic flows associated with capital, they can now be applied to the different capital categories.

When it comes to economic wealth overall, the fundamental flow variable is net investment in all forms of economic assets. This is the value of new investment in these assets during a period net of the depreciation in their value as a result of their use in production. In Chapter III, the term "genuine savings" was introduced to describe changes in total national wealth from one period to the next. To be consistent with the practical replacement of total national wealth with economic wealth in this chapter, 'genuine savings is replaced here by "genuine economic savings" to reflect the narrower focus on just those savings that increase capital used in the market place.

For financial capital, the fundamental flow variable is net investment in foreign financial assets. Investment in domestic financial assets is not relevant, at least not at the level of the whole economy, since an investment on the part of one individual represents a liability on the part of another. Thus, at the aggregate level, domestic holdings of financial assets cancel out and do not contribute to national wealth. It is only the holdings of foreign financial assets that contribute to a nation's wealth[22] and, therefore, only the net investment in these need be measured in an indicator.

For produced capital, the fundamental flow indicator is net investment. This is the value of new investment in produced capital during a period net of the depreciation of the existing produced capital stock.

For human capital, the fundamental flow indicator is also net investment. This would be the value of the increase in human capital during a period less its depreciation. Depreciation of human capital results from the obsolescence of skills (for example, as workers age and fail to keep their skills up-to-date) and the loss of workers from the labour force as a result of retirement, unemployment or other factors. Investment in human capital occurs through education and training and through improvements to health status.

[22] Strictly speaking, national accountants refer to the measure of national wealth including net foreign financial asset holdings as net national worth.

For natural capital, there are several flow indicators that are important. First, for non-critical forms of natural capital – that is, those that can be meaningfully aggregated together and measured in monetary terms – the fundamental indicator is the aggregate value of net depletion. This measure can be supplemented with physical measures of depletion for each of the non-critical stocks to reveal whether aggregate monetary depletion masks important underlying trends in the physical stocks.

A separate flow indicator is required for each critical form of natural capital noted earlier. With respect to a stable and predictable climate, the fundamental flow variable is emissions of greenhouse gases. With respect to clean air, the fundamental variable is emissions of smog-forming pollutants. For clean water, an important indicator is emissions of nutrients (phosphorus and nitrogen) that cause excessive aquatic plant growth, leaving water bodies unsuitable for other aquatic life and for human uses. For intact natural spaces, the fundamental variable is conversion of natural spaces to other uses.

Flow indicators corresponding to the two physical indicators of human capital (health-adjusted life expectancy and percentage of the population with post-secondary education) are also required. In the case of health-adjusted life expectancy, changes in its value will be related to changes in age-specific rates of both mortality and morbidity. Thus, an appropriate flow indicator would be an index of these changes. Further research will be needed before such an indicator can be proposed in specific terms, so it is included here as a place holder. An appropriate flow indicator to parallel the stock indicator of post-secondary graduates is the rate of enrolment in post-secondary institutions.

When it comes to social capital, identifying flow indicators to parallel the proxy stock indicators discussed above is not straightforward. Only the indicator of membership in local associations and networks has an obvious flow parallel: change in membership in the same groups. No obvious flow variable parallels the indicator of trust and adherence to norms or the indicator of collective action. For now, place holders will be included for these two flow indicators.

Summarizing the practical set of capital-based indicators

Table 5 summarizes the discussion of practical capital indicators in the preceding sections. In the end, the practical set includes 15 stock indicators. The flow indicators also total to 15, though both the social capital flow indicators and the indicator of changes in age-specific mortality and morbidity are simply place holders for the time being until research in these areas matures.

Regarding the feasibility of the set, all of the indicators that are not place holders can be estimated today using existing methods and data that are available in most developed nations. However, not all of the methods are equally well established. Some, like those for estimating produced capital, are formally part of official statistical methods. Other methods, like those for measuring human capital or fragmentation of habitats, exist and are used in the research community but are not yet formally recognized as statistical standards.

Table 5. A practical set of capital-based sustainable development indicators

Stock indicators	Flow indicators
Real *per capita* economic wealth	Real *per capita* genuine economic savings
Real *per capita* net foreign financial asset holdings	Real *per capita* investment in foreign financial assets
Real *per capita* produced capital	Real *per capita* net investment in produced capital
Real *per capita* human capital	Real *per capita* net investment in human capital
Real *per capita* natural capital	Real *per capita* net depletion of natural capital
Real *per capita* social capital (place holder)	Real *per capita* net investment in social capital (place holder)
Temperature deviations from normal temperatures	Greenhouse gas emissions
Ground-level ozone and fine particulate concentrations	Smog-forming pollutant emissions
Quality-adjusted water availability	Nutrient loadings to water bodies
Fragmentation of natural habitats	Conversion of natural habitats to other uses
Percentage of the population with post-secondary education	Enrolment in post-secondary educational institutions
Health-adjusted life expectancy	Changes in age-specific mortality and morbidity (place holder)
Membership in local associations and networks	Change in membership in local associations and networks
Trust and adherence to norms	Flow indicators of trust/adherence to norms and collective action (place holder)
Collective action	

Legend: MONETARY INDICATORS
PHYSICAL INDICATORS

C. A capital-based measurement framework

Compiling indicators based on the capital approach – or on any conceptual framework for that matter – requires first translation of the concepts into a practical measurement framework. A measurement framework is a set of methodologies and organizational rules for turning basic data into useful information coherent with the underlying conceptual framework.

The *System of National Accounts* (United Nations et al., 1993) is a good example of what is meant by a measurement framework in this context. The System of National Accounts translates the conceptual framework explaining economic development put forth by John Maynard Keynes and others in the 1930s into an information system for producing the macroeconomic indicators that Keynes and others felt were needed to guide economic policy, principally gross domestic product.

The most obvious starting point for designing a measurement framework for capital-based indicators of sustainable development is, in fact, the *System of National Accounts* (SNA). This is true for several reasons. First, the SNA is already the source for measures of financial and produced capital stocks. Second, as described in more detail below, there already exists a measurement framework for natural capital consistent with the SNA. This is the United Nations *System of Environmental and Economic Accounts* (United Nations et al., 2003). Third, while no fully developed SNA-based measurement framework for human capital exists, many of the data required to compile estimates of human capital are available from the SNA. Thus, it seems likely that an SNA-based measurement framework for human capital could be easily conceived.

Social capital is the one area where little thinking has been done with respect to an SNA-based measurement framework. In principle, such a framework could be devised, particularly insofar as monetary estimates of social capital are concerned. Physical indicators of social capital (self-reported measures of trust, for example) are obviously less well suited to such a framework, though perhaps not more so than the complex physical indicators of ecosystems that are part of the *System of Integrated Environmental and Economic Accounts*.

To illustrate what is possible with regard to an SNA-based measurement framework, the *System of Integrated Environmental and Economic Accounts* is described in more detail below.

The System of Integrated Environmental and Economic Accounts[23]

The *System of Integrated Environmental and Economic Accounts* (SEEA) comprises four categories of accounts.

(a) Flow accounts for pollution, energy and materials 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. The objective is to see the extent to which the economy is dependent on particular environmental inputs and the sensitivity of the environment to particular economic activities. Bringing physical flow data together in these accounts allows links to be made with economic data series, helping answer questions like, “Does an industry which is environmentally

[23] This section draws heavily upon Chapter I of the SEEA handbook (United Nations *et al.*, 2003, pp. 1-23)

sensitive play a particularly large role in international trade of the country or provide many employment opportunities?" In the SEEA, accounts that combine physical environmental and monetary economic data are called "hybrid" environmental accounts. It is flow accounts like those of the SEEA where the data necessary to compile the natural capital flow indicators in Table 5 would be organized in a capital-based measurement framework;

(b) Environmental protection and resource management expenditure accounts identify expenditures undertaken by industry, government and households to protect the environment or to manage natural resources. They take those elements of the existing SNA that are relevant to the good management of the environment and show how the environment-related transactions can be made more explicit. In addition, these accounts also measure the use of economic instruments – taxes, subsidies, licence fees and similar tools – to encourage more environmentally friendly behaviour. The environmental protection and resource management expenditure accounts of SEEA could not be used as the direct source of any of the indicators listed in Table 5. They could, however, serve as a source of important additional information in support of the monetary indicators of financial capital and produced capital. This is because they take the financial and produced capital stock data from the SNA (which would be the source of the corresponding indicators in Table 5) and disaggregate them to show details relevant to natural capital that are hidden in the aggregates. For example, they would show what share of total business investment in construction was devoted to installations designed to protect the environment such as a sewage treatment plant. In principle, the same approach could be used in a capital-based measurement framework to show flows of financial and produced capital relevant to other forms of capital; for example, the share of government investment in construction devoted to building new educational institutions;

(c) Natural resource asset accounts in both monetary and physical terms record stocks of natural resources such as fish, forest, water and minerals, as well as land and ecosystems. It is accounts like the land and ecosystem accounts of the SEEA where the data necessary to compile the indicators of critical natural capital in Table 5 would be compiled in a capital-based measurement framework;

(d) The final set of accounts within the SEEA describes how the production accounts of the SNA can be adjusted to take into account depletion and degradation of natural capital. When such adjustments are applied to GDP, the result is an environmentally adjusted domestic product – EDP – or what is more commonly referred to as "green GDP." Although the techniques discussed in the SEEA for the valuation of depletion and degradation of natural capital are relevant in a capital-based measurement framework, the adjustments to the flow aggregates of the SNA are not.

As can be seen, much of the SEEA is directly relevant for measuring the natural capital indicators proposed in Table 5. Some of it is not directly relevant, but is useful nonetheless for the supplementary information that it provides.

The lesson of the SEEA shows that it is possible to craft a coherent and rigorous measurement framework for complex, non-traditional forms of capital starting from the basic elements of the SNA. What matters most is consistency with the core conceptual and organizational principles of

the SNA; for example, use of the same dividing lines for breaking the economy up into institutional sectors and common standards for classifying industries.

D. A note on distributional issues in the capital approach

The capital approach is sometimes criticized for not taking adequate account of distributional issues. Aggregate measures of capital, it is noted, can mask significant differences in access to capital stocks – and, therefore, the potential for well-being in the long term – among different groups in society.

While it is true that aggregate capital measures do not offer insight into the access to these resources by different groups, it should be noted that this problem is not inherent to the approach itself, but to the nature of aggregate indicators. In their effort to simplify and summarize complex issues into relatively easily understood measures, aggregate indicators necessarily mask information that might be considered important for some purposes. This is true of many indicators commonly produced by statistical offices and used in public policy, including gross domestic product, crime rates and literacy rates. The usefulness of these indicators for communicating broad trends and indicating where public policy attention might have to be focused is unquestioned.

At the same time, there are legitimate reasons to ask questions about how different groups within society fare with respect to these important variables. Crime, for example, is known to affect society differentially and additional insight into crime and its effects can be found by disaggregating crime statistics by social stratum (say, by income level) and producing indicators of crime for different social groups. This is, indeed, quite often done in national statistics.

The same disaggregation by social stratum is possible, in principle, for the capital-based sustainable development indicators described in this chapter. Generally speaking, the techniques for doing so are not complicated. So long as the necessary statistics are available at a sufficient level of disaggregation, it is possible to produce indicators showing the distribution of access to capital by different groups within society. For example, it is possible (and, in fact, often done) to produce statistics showing the distribution of financial and produced wealth among the members of a society in deciles, allowing comparison of the wealth in terms of these assets of the bottom ten percent of society with the top ten percent.

E. Policy implications of the capital approach

It is a reasonable question to ask what would be the benefits from a data user's point of view of compiling sustainable development indicators using a capital approach. What insight into sustainable development would, say, an official of an environment ministry or a finance ministry gain if given a set of capital-based indicators that he/she might not have otherwise? The answer to this question has four parts.

Helping focus on the long-term determinants of development

Current economic and social policy making in most countries is focused primarily on maximizing well-being in the near term. This focus is driven by the short time horizon of

democratic governments, by the fact that individuals usually prefer benefits today rather than benefits in the future and by the information produced today in support of policy making, most of which measures elements of short-term well-being. All of this can make it hard for those making development decisions to keep a focus on the long-term determinants of well-being.

The capital approach, rooted as it is in well-established development theory, provides a sound basis for indicators aimed at measuring long-term well-being. Its theoretical roots also mean that capital indicators may be less subject to change by successive governments than indicators closely linked to policy processes. This means the indicators should stand the test of time, allowing governments time to learn how to use them in shaping policies for the long-term.

Clarifying the distinction between current income and capital consumption

With its emphasis on the maintenance of stocks of capital as the basis for long-term well-being, the capital approach makes clear the distinction between current income and capital consumption.

Current income is the maximum amount that can be consumed while leaving oneself as well off at the end of a period as at the beginning (Hicks, 1965). It is this income – and only this – that a nation can spend on current consumption without impoverishing itself over time.

When current income is exceeded, then capital is being consumed. Capital consumption is the drawing down of stocks of capital, either by using them up (in the case of natural resources or financial assets) or by degrading them so that they are less able to produce well-being-enhancing flows of goods and services. Capital consumption can be a means of supporting consumption in the current period, but it is not "income" in the true sense, because it cannot be supported indefinitely. Eventually, capital will be entirely consumed if it is not replenished.

With the distinction between current income and capital consumption clearly made within the approach, capital-based indicators will reveal when current well-being is being supported by the drawing down of capital stocks rather than by current income. This information should be valuable in designing policies to avoid consuming capital to support current consumption. This could be of particular value in natural resource-dependent countries, where resource management policies have a significant impact on the long-term development prospects. It would show how nations that reinvest the returns from depleting natural resource capital in other forms of productive capital will, in the long term, enjoy greater current well-being than those that use these returns to finance consumption today.

Thinking more broadly about the concept of investment

Traditionally, governments and enterprises have thought of investment in terms of increasing their stocks of produced capital (buildings, machinery, etc.) and financial capital (stocks, bonds, etc.). More recently, the notion of investment has been extended to include investment in knowledge through research and development and investment in workers through education, training and health care.

The traditional view of investment has served well in the past, as it focused surplus resources (savings) into increasing stocks of capital that were the limiting factors on economic development. Increasingly though, this traditional focus requires expanding as other factors, notably the environment, emerge as limiting factors on development.

By extending the traditional view of capital to include natural capital, human capital and social capital, the capital approach provides a coherent framework for thinking more broadly about investment. Such a broader focus could have many implications for policy making. Environmental policy, for example, could come to be seen as a means of strategically investing in the long-term well-being of society. So too for investments in human and social capital.

Understanding where the greatest return on investment can be had in natural, human and social capital will take time. By providing a coherent and stable set of indicators over time, the capital approach will facilitate the development of effective policies to achieve this goal of long-term sustainability.

Balancing current well-being with maintenance of capital

As noted above, governments have focused – for obvious and good reasons – for most of the post-World War II period on ensuring growth of current well-being. While current well-being will always be a concern, it is becoming increasingly apparent, particularly with respect to the environment, that this focus has come at the expense of important parts of the capital basis that supports well-being in the long term. If the development success that has been achieved (in developed countries at least) is to be maintained in the future, greater balance now seems essential between current well-being and maintaining the basis of well-being in capital. By providing indicators that reflect the evolution of capital over time, the capital approach can provide information to support this rebalancing.

The next chapter explores how the capital-based indicators discussed in this chapter compare with the indicators most commonly used by governments to date in assessing sustainable development. As will be seen, there is a considerable degree of overlap.

Chapter V: EXPLORING A SMALL SET OF SUSTAINABLE DEVELOPMENT INDICATORS

Having described and characterised existing policy-based approaches to sustainable development indicators in Chapter II and discussed the capital approach in conceptual and practical terms in Chapters III and IV, the time has come to propose a small set of sustainable development indicators that might serve for the purpose of international comparison.

A. Comparing the two approaches

Strengths and weaknesses

It is useful to begin the comparison of the two approaches by recalling their strengths and weaknesses as discussed earlier in this report.

With respect to the indicators based on national policies, the close connection between the indicators and the national goals established for sustainable development is their main strength (Table 6). This obviously does much to ensure the policy relevance of the indicators. It does, however, mean that indicators may be more open to stakeholder influence – running against one of the central tenets of official statistics – and may be subject to change whenever national policies change. While change is not in itself undesirable, change that is too frequent or too broad can undermine the utility of indicators.

With respect to capital-based indicators, their main strength is their clear and well-established conceptual basis. However, as shown in Chapters III and IV, there are problems, in some cases serious, in translating the conceptual ideal of the capital approach into practical indicators that would meet the quality standards of official statistics. The other main weakness, at least for some, is that capital-based indicators offer little help in measuring short-term well-being. For those who hold that the goal of sustainable development is to ensure both the well-being of those currently living and the potential for the well-being of future generations (what was referred to earlier at the integrated view), capital-based indicators will fall short of what is needed to measure sustainable development.

Table 6. Comparing the two approaches: strengths

Capital-based indicators	Policy-based indicators
Based on a clear and well-established conceptual framework for measuring sustainable development that provides useful guidance when analysing the indicators and the relationship between them. Comprehensive coverage of issues relevant to sustainable development from the future-oriented perspective in a relatively small set	Relate directly to national policy frameworks for sustainable development, making them highly relevant to established goals. Often selected through direct interaction with stakeholders, ensuring an audience for the indicators when published. Often easy to understand intuitively. Open to new issues as they emerge.

that should not change greatly over time. Based on the extension of a framework familiar to ministries of finance, who have traditionally not been major users of sustainable development indicators.	

Table 7. Comparing the two approaches: weaknesses

Capital-based indicators	Policy-based indicators
Not possible today to move from theory to practice across all elements of the approach, especially with respect to valuation of complex forms of capital. Short-term well-being dimension of sustainable development not covered, limiting the utility of the approach to long-term issues. Framework may appear too "economic" or too complex to some users.	Not based on any clear conceptual framework and, therefore, may seem *ad hoc*. Link to sustainable development sometimes difficult to rationalize. Often cover a large number of issues in a single set, making it difficult to determine clearly whether development is sustainable or not. Can be unstable over time as new policy issues arise.

B. Identifying commonalities and differences

It may seem easier to identify differences among the two approaches than commonalities. On the one hand, there exists a heterogeneous collection of indicator sets stemming from existing national and international policy frameworks. On the other hand, we have a small set of indicators – in the ideal case, just a single indicator – based on the conceptual framework of capital.

However, as was shown in Chapter II, behind the heterogeneity of the existing indicator sets one finds common themes and indicators appearing in many sets. Their heterogeneity is therefore not as large as it may appear at first instance. And even if the ideal capital-based indicator set contains just one indicator, in practice such a set contains 30 indicators, leaving considerable room for overlap with existing sets.

A mapping between the indicators most commonly found in policy-based sets (from Table 3) and the suggested indicators based on the capital approach (from Table 5) is shown in Table 8.

Only those capital-based indicators for which a corresponding indicator exists in the common policy-based set are shown in Table 8. Indicators from the common policy-based set that have a direct or very similar counterpart in the capital-based set are shown in yellow. Indicators that have no counterpart but that are conceptually related to the capital approach are shown in light blue. Those for which no meaningful conceptual or practical link to the capital approach is possible are shown in dark blue.

Table 8. Commonalities between policy-based indicators and capital-based indicators

Indicators common to policy-based sets[1,2]	Matching or similar indicators from the capital-based set
Greenhouse gas emissions	Greenhouse gas emissions
Education attainment	Percentage of the population with post-secondary education
GDP *per capita*	Not related at all to the capital approach
Collection and disposal of waste	Related to depletion of natural capital
Biodiversity	Fragmentation of natural habitats
Official Development Assistance	Potentially related to various forms of capital
Unemployment rate	Related to human capital stocks
Life expectancy (or Healthy Life Years)	Health-adjusted life expectancy
Share of energy from renewable sources	Related to depletion of natural capital
Risk of poverty	Related to human and social capital stocks
Air pollution	Ground-level ozone and fine particulate concentrations
Energy use and intensity	Related to depletion of natural capital
Water quality	Quality adjusted water availability
General government net debt	Related to financial capital
Research & Development expenditure	Related to produced capital
Organic farming	Only secondarily related to natural capital
Area of protected land	Related to natural capital stocks
Mortality due to selected key illnesses	Changes in age-specific mortality and morbidity (place holder)
Emission of ozone precursors	Smog-forming pollutant emissions
Fishing stock within safe biological limits	Related to natural capital stocks
Use of fertilisers and pesticides	Nutrient loadings to water bodies
Freight transport by mode	Only secondarily related to natural capital
Passenger transport by mode	Only secondarily related to natural capital
Intensity of water use	Related to depletion of natural capital
Forest area and its utilisation	Related to natural capital stocks

1. Indicators that are found in at least 10 existing national or international sets (Eurostat, 2007b).
2. The energy consumption and employment rate indicators included in Table 3 have been removed here because they essentially duplicate the indicators of energy use and intensity and unemployment rate.

As can be seen in Table 8, the majority of the common policy-based indicators are either directly comparable to a capital-based indicator or conceptually related to the approach. This offers much potential for identifying a small set of indicators compatible with both approaches. Before turning to this small set, the reasons why some indicators appear on the policy-based list but not on the capital list, and *vice versa*, are explored.

Explaining differences between the approaches

There are just five indicators in the list of 27 commonly found policy-based indicators that do not fit meaningfully into the capital approach:

(a) GDP *per capita*;

(b) Official development assistance;

(c) Organic farming;

(d) Freight transport by mode; and

(e) Passenger transport by mode.

Of the five, GDP *per capita* is both the most commonly found in policy-based sets and, arguably, the most distant from the capital approach. Gross domestic product is, as was explained in Chapter III, the income that society manages to generate from its capital base. It is highly relevant for understanding current well-being, as individuals use their income to purchase all sorts of things that enhance their well-being. As a measure of the potential for maintaining well-being in the long-term, however, GDP is an inappropriate and even misleading measure. A high level of income today is no guarantee of the same in the future. Indeed, it may actually reduce well-being in the future if some of the income is generated by consuming society's capital base. Thus, GDP *per capita* is not coherent with any approach to sustainable development, like the capital approach, focused on well-being in the long term.

An indicator of official development assistance (ODA) is also commonly found in policy-based sets, but cannot easily be reconciled with the capital approach as conceived. Only by making the assumption that all ODA is used to increase capital in the recipient nation could a general indicator of ODA be considered a capital indicator. Of course, some ODA is used to create capital – to educate children or to build hospitals, for example. A modified version of this indicator, measuring ODA for investment purposes, could, then, be compatible with the capital approach.

Indicators of organic farming, passenger transportation and freight transportation are indirectly related to a number of stocks and flows of importance in the capital framework. Organic farming will impact use of fertilizers and pesticides as well as land use. Transportation is the source of much air pollution, with different modes contributing different pollutants in different amounts per unit of activity. Land-based transportation also uses up significant space that could serve other purposes.

Though they are related to capital stocks in these ways, measures of organic farming, passenger and freight transportation would provide little additional value in assessing the potential for long-term well-being beyond the proposed set of capital indicators. The main effects of organic farming would be captured in the nutrient loading indicator and the main effects of transportation would be captured in the indicators of smog-forming pollutants and greenhouse gas emissions. To the extent they impact long-term well-being, the land use effects of both farming and transportation would be captured in the indicator of habitat fragmentation.

Turning to the indicators that appear in the capital-based set but not in the policy-based set, it is immediately apparent that none of the monetary indicators in the capital set appears directly in the policy-based set. However, several of the policy-based indicators are closely related to monetary indicators from the capital set:

(a) The policy-based indicator of general government net debt is closely related to the capital-based indicator of real *per capita* net foreign financial assets holdings. Often, net government foreign debt is an important element of total net foreign financial asset holdings. The policy-based indicator of research and development expenditure is closely related to the capital-based indicator of real *per capita* investment in produced capital. Research and development expenditures are simply a subset of overall produced capital investment;

(b) The policy-based indicators of area of protected land; fishing stock within safe biological limits; and forest area and its utilisation are closely related to the capital-based stock indicator of real *per capita* natural capital wealth. They are simply the physical analogues of the wealth estimates for protected areas, fish stocks and forest resources that would form part of the total estimate of natural capital wealth. Producing such physical indicators is actually a necessary first step in the valuation of natural capital, so these indicators are fully compatible with the capital approach. It should be noted, though, that these indicators are necessary but not sufficient for estimating natural capital wealth;

(c) The policy-based indicators of collection and disposal of waste; share of energy from renewable sources; energy use and intensity; and intensity of water use are all closely related to the capital-based flow indicator of real *per capita* net depletion of natural capital. As above, compiling these indicators is a necessary, but also not sufficient, first step in the valuation of changes in natural capital stocks, so they too are fully compatible with the capital approach;

(d) The policy-based unemployment rate indicator is closely related to the monetary capital-based indicator of real *per capita* human capital. Data on unemployment are necessary in the estimation of the monetary value of human capital. Again, then, this indicator is fully compatible with the capital approach;

(e) It is reasonable to suggest that the policy-based indicator of risk of poverty is related to the monetary indicators of human capital and social capital, although the nature of this relationship can only be expressed in general terms. In the case of human capital, poverty can limit access to education and health, reducing the ability of the poor to contribute to their full economic potential. These effects will be captured in the aggregate monetary indicator of human capital, however, so poverty may be more of an explanatory or proxy variable than a direct indicator of human capital.

In the case of social capital, poverty could be expected to have a number of negative effects that would, in principle, be captured in a monetary indicator. So, poverty may again be best thought of as an explanatory or proxy variable for social capital. This question is left as a matter for further research.

There are two monetary indicators in the capital-based list that have no analogue at all in the policy-based set: the stock and flow indicators for economic wealth. This should come as no surprise, as it is one of the innovations of the capital approach to suggest such indicators. One would expect to find them only in an indicator set explicitly based on capital.

At this point, all the indicators in the capital-based list have been discussed in relation to the policy-based list with the exception of:

(a) The stock indicator of climate stability (deviation from temperature normals);

(b) The flow indicator of intact natural landscapes (conversion of natural habitats to other areas);

(c) The flow indicator of human capital (post-secondary enrolment); and

(d) The proxy indicators of social capital (memberships in local organizations, trust and collective action).

The absence of a stock indicator related to climate among the common policy-based indicators is again no real surprise, as its presence would only be expected in a set explicitly based on capital. It is much more common to focus on greenhouse gas emissions in policy frameworks, since these can actually be controlled by policy action.

That there should be no flow indicators for human capital and critical natural landscapes among the common policy-based indicators is somewhat surprising, but not a particular sign of incoherence between the two approaches. Both post-secondary enrolment and conversion of natural areas to other uses are important indicators for policy and, therefore, could be easily imagined in a set of policy-based indicators.

That there should be no indicators related to social capital (with the exception of risk of poverty) among the common policy-based indicators reflects the fact that social issues are treated in widely varying ways in existing sustainable development policy frameworks. There are many social indicators in these frameworks, but few of them are common to more than a few frameworks. Clearly, the way in which social issues are related to sustainable development remains a matter of considerable divergence of opinion. This is consistent with the difficulties noted in Chapters III and IV in defining social capital.

The above comparison between capital-based and policy-based indicators of sustainable development can be summarized in the following points:

(a) First, few monetary indicators are commonly found in policy-based sets while these figure centrally in the capital-based set. In particular, there is no effort in policy-based sets to measure sustainable development with highly aggregated monetary indicators like economic wealth. Many common policy-based indicators are, however, closely related to the monetary indicators of individual capital stocks even if they are measured in physical terms;

(b) There are very close and even direct relations between a number of common policy-based indicators and the physical indicators of human and natural capital stocks;

(c) Only a few common policy-based indicators cannot be reconciled with the capital approach. Among these, GDP *per capita* is the most important. It is simply not possible to justify selection of any indicator based on GDP as a sustainable development indicator from the capital perspective.

With this summary in mind, attention can be turned to defining – in an exploratory fashion – a small set of sustainable development indicators that might be consistent with the capital approach, relevant from the policy perspective and suitable for comparing performance among countries.

C. Exploring a small set of sustainable development indicators

Drawing inspiration from both the capital approach and from existing policy frameworks, the following small set of sustainable development indicators is proposed.

Table 9. A proposed small set of sustainable development indicators

Indicator domain	Stock Indicators	Flow Indicators
Foundational well-being	Health-adjusted life expectancy	Changes in age-specific mortality and morbidity (place holder)
	Percentage of population with post-secondary education	Enrolment in post-secondary education
	Temperature deviations from normals	Greenhouse gas emissions
	Ground-level ozone and fine particulate concentrations	Smog-forming pollutant emissions
	Quality-adjusted water availability	Nutrient loadings to water bodies
	Fragmentation of natural habitats	Conversion of natural habitats to other uses
Economic well-being	Real *per capita* net foreign financial asset holdings	Real *per capita* investment in foreign financial assets

	Real *per capita* produced capital	Real *per capita* net investment in produced capital
	Real *per capita* human capital	Real *per capita* net investment in human capital
	Real *per capita* natural capital	Real *per capita* net depletion of natural capital
	Reserves of energy resources	Depletion of energy resources
	Reserves of mineral resources	Depletion of mineral resources
	Timber resource stocks	Depletion of timber resources
	Marine resource stocks	Depletion of marine resources

As can be seen, the proposed small set in Table 9 has been divided into two indicator domains. The first is labelled foundational well-being to reflect the fact that the indicators measure stocks and flows that are essential to the well-being of society. The second domain is labelled economic well-being. The indicators within it are more narrowly related to the well-being derived from market activity.

In selecting the indicators for inclusion in the small set, the following decisions were made:

(a) As a general rule, to be included in the small set an indicator had to be consistent with the capital approach and identifiable with an indicator found among the most common indicators from policy-based sets;

(b) No particular effort was made to include only indicators that are methodologically well-established or feasible today in all countries. Rather, priority was given to selecting a small set that is as robust and complete as possible. As it happens, though, most of the indicators in the set may in fact be developed today using methodologies outlined either in the academic literature or in statistical guidelines. Some of these methodologies – for example, those related to human capital valuation (Jorgenson and Fraumeni, 1987; Jorgenson and Fraumeni, 1992; Wei, 2004) – remain experimental and may not yet meet the standards of official statistics. Not all of them will be feasible in all countries. The small set should therefore be considered a goal to which some countries will have to aspire, though it is largely practical for countries with well-established statistical systems;

(c) No distribution- or efficiency-based indicators were included. This is not because distribution of wealth and efficient use of assets are unimportant to sustainable development, but because distributional or efficiency versions of most of the indicators in the small set can be easily compiled using basic statistical techniques. To the extent that such indicators are relevant in a given country, the small set can be expanded to include them. However, it would not be recommended that distributional or efficiency indicators be compiled instead of the proposed indicators, but in addition to them;

(d) No indicators related to social capital were included. Even though proxy indicators of social capital were included in the proposed list of capital indicators in Chapter IV (Table 5), it was not felt that these are sufficiently robust either theoretically or methodologically to be proposed for the small set. The fact that only one indicator related to social capital is found among the most common indicators in existing policy-based sets was another reason for excluding social indicators from the small set. Clearly, further research will be necessary before social indicators consistent with the capital approach and relevant to sustainable development policy across a large number of countries can be proposed;

(e) The aggregate monetary indicator of economic wealth was not included. Although this indicator is highly relevant to the capital approach, it is far from what is currently measured in policy-based sets. For that reason, its inclusion in the small set was felt to be unjustified for now. Further research is suggested (see Chapter VI) before deciding finally upon the inclusion of this indicator in the small set.

(f) The aggregate monetary indicators of financial, produced, natural and human capital were included. The inclusion of the financial and produced capital indicators is consistent with existing policy-based indicators, as was noted in the discussion of Table 8 above, and should not be controversial. The inclusion of the monetary natural and human capital indicators is justified in two ways. First, their exclusion would be inconsistent with the inclusion of the financial and produced capital indicators. If the wealth associated with financial and produced capital is considered relevant to sustainable development, then surely so must the wealth associated with natural and human capital. Second, as was noted in the discussion of Table 8, many of the indicators in existing policy-based sets are closely related to human and natural capital, even if they are measured in physical terms. So that the proposed small set is consistent with both the capital approach and existing policy approaches, the small set also includes a number of physical indicators of non-critical natural capital among the economic well-being indicators. Physical indicators of human capital are included among the foundational well-being indicators.

There are 28 indicators in the proposed small set. While this is a large number, it is fewer than in most policy-based sets – in some cases much fewer (see Table 1). The indicators in the small set represent a theoretically robust, substantially complete and policy-relevant approach to measuring sustainable development. Any country that compiled them all would be in a very good position to report upon its potential for sustaining well-being in the long term. If many countries were to compile them as part (or all) of their national sustainable development indicator sets, the basis for comparing progress across nations in terms of achieving sustainable development would be greatly improved.

The set is not of as much use for reporting on the elements of current well-being, though it is far from useless for this purpose. The set also cannot correspond perfectly to the policy priorities in all countries. For both these reasons, any given country might feel that the proposed small set is insufficient to meet its needs for measuring sustainable development. To the extent that this is true, the small set can, of course, be supplemented with additional indicators reflecting the national situation.

As a final, perhaps obvious, point, it is worth emphasizing that the small set of indicators on its own should not be thought of as all that is relevant to measuring sustainable development. Indicators by their nature tell a very high-level story. They are valuable for pointing out where a policy may not be having its desired effect, but they are not likely to reveal why this is the case. Thus, indicators are most useful for crafting and assessing policies when they are built upon well-organized underlying data structures. In Chapter IV, the need for a measurement framework for just this purpose was discussed and it was suggested that the *System of National Accounts* represents the most suitable starting point for creating such a measurement framework.

Fulfilling all of the requirements to produce the small set of indicators and the associated measurement framework is obviously difficult. Priorities will have to be established to focus on achievable goals and progress will have to be made in a stepwise fashion. Thus, the development of sustainable development indicators should be seen as an evolutionary exercise. Over time, it will become clear where data are inadequate or missing entirely, providing a useful guide to development of basic statistics.

Chapter VI: CONCLUSION

Sustainable development is a popular and important concept, but one that is open to a variety of interpretations. Since the 1987 Brundtland report (World Commission on Environment and Development, 1987), many researchers in universities, environmental organizations, think-tanks, national governments and international agencies have offered proposals for measuring sustainable development. The wide variety of indicators in existing national and international policy-based sets, as described in Chapter II, testifies to the difficulty of the challenge.

This report has attempted to contribute to the debate by drawing the best from the conceptual work of researchers and the practical work of policy makers and statisticians. The mandate given to the Working Group on Statistics for Sustainable Development by the United Nations Conference of European Statisticians was to consider the conceptual approach to measuring sustainable development based on capital and to compare this with the indicators most commonly found in existing national and international indicator sets. This was a novel undertaking and, therefore, it is hoped this report will be seen as a beneficial contribution to what is, admittedly, an already crowded debate.

The Working Group's efforts can be viewed as a success from a number of perspectives. Importantly, over the course of two years of discussions, there emerged a significant convergence of opinion among the members of the group. While at the outset there was doubt on the part of some about the value of an approach based on capital and doubt on the part of others of the effectiveness of existing indicator sets, at the end there was greater understanding of the role each has to play. For this alone, the work of the group can be considered to have been worthwhile.

The very thorough discussions of the capital approach have helped clarify many of the central concepts and, more importantly, identify where further work is needed to clarify these concepts if they are to become more widely accepted.

Finally, and most importantly, the work of the group has lead to the proposal of practical set of sustainable development indicators that might serve as the basis for international comparisons (see Table 9). This set is consistent with the capital approach and with the most common elements of existing policy-based indicator sets. It is relatively small (28 indicators) and has a high degree of internal coherence, with most elements of sustainable development treated in a related pair of stock and flow indicators.

However, the small set does not cover all of the elements of sustainable development found in national and international policy frameworks. Most of these frameworks take an integrated view of sustainable development that suggests the need to ensure both current well-being and the potential for future well-being. As a result, a number of the indicators found in existing policy-based sets are related to current well-being and have little to do with measuring the potential for creating well-being in the long term.

The capital approach, on the other hand, is focused precisely on measuring the determinants of well-being in the long-term (stocks of capital). In this way, it is coherent with a future-oriented view of sustainable development.

Derived from the intersection of capital-based indicators and the most common policy-based indicators, it is necessarily the case that the small set of indicators proposed in Table 9 is also focused on the determinants of future well-being. It is perhaps surprising, though, the degree to which the small set is coherent with the most common policy-based indicators. As noted in the comparison of the capital-based indicators and the policy-based indicators (Table 8), all but a few of the common policy-based indicators find either a direct counterpart or a close relation in the capital-based set.

This suggests that a focus on the future determinants of well-being is central not just to the capital approach, but also to existing policy-based indicator sets. The relative absence of indicators of current well-being from the most common policy-based indicators (with the notable exception of *per capita* gross domestic product) reflects the breadth of views that exists with respect to the determinants of current well-being. While there are many individual indicators of current well-being in policy-based sets, they are divergent enough as to not figure prominently among the most common indicators. Such breadth is to be expected, as social scientists have not yet established a universally held view of what determines current well-being.

The small set of indicators in Table 9 is offered in an exploratory fashion only. It is not intended as an international recommendation, but as a research proposal worthy of consideration by countries interested in finding a conceptually clear and defensible basis for sustainable development indicators focused on long-term well-being.

It is not possible to be more definite at this time because there are several issues still to be settled about the capital approach. As discussed extensively in Chapters III and IV, the capital approach is very well established in many of its elements, but relatively underdeveloped in some. In particular, questions remain regarding the calculation of economic wealth, the appropriate physical indicators for critical forms of capital and the definition and measurement of social capital. These issues are each discussed briefly below by way of establishing a research agenda for further statistical work on the topic.

A. Research agenda for the capital approach

Measuring economic wealth

Chapter III devoted considerable space to explaining why total national wealth is an ideal indicator of sustainable development in theory but not feasible in practice. In Chapter IV, a practical alternative to the theoretical ideal labelled economic wealth was presented. By focusing on just the well-being associated with capital assets bought and sold in the market, economic wealth avoids the difficulty of measuring unobservable accounting prices for capital assets.

Though economic wealth is much less problematic as an indicator than total national wealth, it is not without measurement difficulties. To date, the most thorough empirical work on economic wealth has been undertaken by the World Bank (2006). In this work, economic wealth is calculated as the present value of future national income, an approach validated by economic theory but requiring a number of assumptions to put into practice. A central assumption is that existing relative prices are a valid basis for determining the sustainability of current income. To the extent that these

prices are distorted by the market's failure to internalize significant externalities, this assumption may not be valid. This question deserves further scrutiny.

Additional assumptions are required about the future path of income. Investigation is required to determine the degree to which estimates of economic wealth are sensitive to these assumptions.

Finally, in the work to date, the sources of economic wealth have not been determined with a great deal of precision. The results leave a large share of economic wealth for many countries in a "residual" broadly defined to include human, social and institutional capital. Further empirical work is needed to see whether this residual can be more fully explained.

Physical indicators of critical capital

It was explained in Chapter III that some forms of capital are critical; that is, they cannot be done without because they provide services that are not available from any other form of capital. Critical capital stocks must not be measured along with other forms of capital in aggregate monetary indicators, but must be measured in individual indicators expressed in suitable physical units of measure.

In Chapter IV it was noted that critical capital is common in natural capital and that it is probably also found in other categories of capital. A preliminary set of critical natural capital indicators was proposed in Table 5. Additional research could usefully be conducted to determine whether improvements to it are possible. As for other critical capital assets, additional research will be required to determine what these might be and how they might be measured.

Defining and measuring social capital

Reference was made at several points in Chapters III, IV and V to the difficulties in defining and measuring social capital. These difficulties are reflected in the tentative way in which social capital indicators were treated in the list of capital-based indicators in Table 5 and in the fact that social capital was excluded from the proposed small set of indicators for international comparisons in Table 9. Additional research will be necessary before social capital can be treated with more certainty within the capital approach. Some suggestions for avenues that might be pursued are given below.

Defining social capital as networks and their associated norms seems most promising. Although there has been criticism of the network approach, particularly with respect to the difficulty in defining "trust" and "networks" (Labonte, 1999), there has been significant progress in recent years. Several countries have undertaken measurement of social capital using a network approach, including the Australia, Canada, the United Kingdom and the United States.

Networks can be described and analysed by their structure and quality. Network structure refers to "physical" and easily quantifiable characteristics such as size, density, diversity, frequency and mode. Network quality refers to "cognitive" aspects reflecting the norms and values of the culture in which the network exists, such as trust, efficacy, inclusiveness, intensity, sense of purpose and reciprocity.

Networks come in three types (bonding, bridging and linking) and they can be seen to function across two social planes (horizontal and vertical). Bonding networks connect similar and equal individuals, groups or institutions (horizontal plane). Bridging networks connect dissimilar people at the same level (horizontal plane). Linking networks connect individuals, groups and institutions to authority (vertical plane).

Within a sustainable development context, there appear to be two important areas to consider. The first is the ability of a society to work together and the second is a stable political, legal and cultural framework. Therefore, indicators that focus on linking and bridging networks would seem most relevant to the capital approach. A preliminary set of such indicators is shown in Table 10 as a starting point for further research.

Table 10. Preliminary network indicators for social capital

Network type	Suggested indicators
Bonding	Resident population and sub-populations
	Number of people actively involved in clubs, organisations or associations
	Number of partnerships among government, academia and business involved in research and development
	Level of generalised trust
	Level of victimisation
	Level of social exclusion
Bridging	Level of unemployment
	Level of organised crime
Linking	Level of government effectiveness
	Level of institution trust
	Level of corruption
	Number of human rights violations

B. Last words

Inevitably, within a large group like the Working Group on Statistics for Sustainable Development, opinions will differ on important matters. But, at the end of this report, it is not differences of opinion that stand out but, rather, the convergence that has taken place in the Group's collective thinking about sustainable development and its measurement. The thinking behind the many national and international sustainable development policy frameworks is better understood and appreciated now than it was at the beginning. Likewise, the value of looking at sustainable development from a tightly articulated conceptual perspective is also more widely recognized as having value.

What is most striking about the outcome, though, is the degree to which indicators based on the capital approach have been found to be coherent with the most widely found indicators in existing policy-based sets. It is fair to say that few members of the Working Group expected this outcome when the work began. The result of this coherence is a small set of sustainable development indicators that, while still exploratory, should be of considerable appeal in many countries. If a number of countries, regional groupings (like the European Union) and international organizations, were to work toward compiling this set of indicators, much could be gained in terms international comparability of progress towards ensuring well-being in the long-term.

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ANNEX 1

LIST OF AUTHORS WHO CONTRIBUTED PAPERS IN THE COURSE OF THE WORK OF THE JOINT UNECE/OECD/EUROSTAT WORKING GROUP ON STATISTICS FOR SUSTAINABLE DEVELOPMENT

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ANNEX 2

LIST OF MEMBERS OF THE JOINT UNECE/OECD/EUROSTAT WORKING GROUP ON STATISTICS FOR SUSTAINABLE DEVELOPMENT WHO ATTENDED THE MEETINGS

ARMENIA National Statistical Service of the Republic of Armenia	Mr. Stepan Mnatsakanyan Ms. Anahit Safyan
AUSTRALIA Australian Bureau of Statistics	Mr. Michael Vardon
AUSTRIA Statistics Austria Ministry of Agriculture, Forestry, Environment and Water Management	Mr. Ferdinand Kassberger Ms. Ingeborg Fiala
BELGIUM SVR - Research Centre of the Flemish Government Federal Planning Bureau	Mr. Peter De Smedt Ms. Natacha Zuinen
BULGARIA National Institute of Statistics	Ms. Diana Yancheva
CANADA Statistics Canada	Mr. Robert Smith
CHILE National Statistical Institute of Chile	Ms. Mariana Schkolnik Chamudes Ms. Veronica P. Oxman Vega Ms. Lylian Mires Aranda
CZECH REPUBLIC Czech Statistical Office	Mr. Slavoj Czesany
CYPRUS Statistical Service of Cyprus Ministry of Finance	Mr. George Georgiou
DENMARK Statistics Denmark	Mr. Kristian Hjulsager

ESTONIA *Statistical Office of Estonia* Estonian Institute for Sustainable Development/Stockholm Environment Institute	 Ms. Eneli Niinepuu Ms. Urve Kask Ms. Tea Nommann
FINLAND Statistics Finland	 Mr. Leo Kolttola
FRANCE INSEE French Institute for Environment	 Ms. Sylvie Le Laidier Ms. Cécile Dormoy Ms. Françoise Nirascou
GERMANY Federal Statistical Office	 Mr. Joachim Thomas
GREECE National Statistical Service of Greece	 Mr. Panagiotis Vlachos
HUNGARY Ministry of Environment and Water Hungarian Central Statistical Office	 Mr. Elemer Szabó Ms. Ildikó Szũcs Mr. Attila Rausz Ms. Andrea Meszaros
IRELAND Central Statistics Office	 Mr. Pat Fanning
ISRAEL Central Bureau of Statistics	 Mr. Amit Yagur-Kroll
ITALY Italian Agency for Environment Protection and Technical Services ISTAT	 Ms. Roberta Pignatelli Mr. Corrado Abbate Ms. Stefania Schipani
LATVIA Latvian Environment, Geology and Meteorology Agency Central Statistical Bureau of Latvia Latvian Environment, Geology and Meteorology Agency	 Ms. Sanita Sīle Ms. Inita Buce Ms. Dace Vainauska
LITHUANIA Statistics Lithuania	 Ms. Jurate Jokubauskaite Ms. Danute Zilinskiene Ms. Liberiene Birute

LUXEMBOURG	
Ministère de l'Environnement	Mr. Eric De Brabanter
Service Central de la Statistique et des Etudes Economiques	Mr. Victor Molling
MONTENEGRO	
Statistical Office of Montenegro	Mr. Ilija Stanisic Mr. Vladimir Radenovic
NETHERLANDS	
Statistics Netherlands	Mr. Peter Kee Mr. Rutger Hoekstra Ms. Anna Kulig
NEW ZEALAND	
Statistics New Zealand	Ms. Rachael Milicich Mr. Kent Hammond
NORWAY	
Ministry of Finance	Mr. Thorvald Moe
Statistics Norway	Ms. Julie Hass Mr. Olav Ljones Mr. Knut Alfsen
Ministry of Environment	Mr. Oyvind Lone Mr. Mads Greaker Mr. Per Arild Garnasjordet
POLAND	
Central Statistical Office of Poland	Ms. Dominika Rogalinska
PORTUGAL	
National Statistical Institute	Mr. Albano Miranda Ms. Isabel Quintela
REPUBLIC OF KOREA	
Korea National Statistical Office	Mr. Jung Su Choi Mr. Chul Joo Kim
ROMANIA	
National Institute of Statistics	Mr. Dan Ion Ghergut Mr. Nicolae Cristian Stanica Mr. Ilie Dumitrescu Ms. Livia Dragusin
National Centre for Sustainable Development	Ms. Ana Vasiliu Mr. Radu Stefan Vadineanu
SERBIA	
Statistical Office of the Republic of Serbia	Mr. Dragan Vukmirovic

SLOVAKIA Statistical Office of the Slovak Republic	Mr. Marian Labaj Mr. Karol Papaj
SLOVENIA Statistical Office of the Republic of Slovenia	Ms. Mojca Suvorov
SPAIN National Statistical Institute	Mr. Pedro Javier Herrera Giménez Mr. Jorge Saralegui Mr. Cesar Berrade
SWEDEN Statistics Sweden	Ms. Viveka Palm
SWITZERLAND Swiss Federal Statistical Office	Ms. Andrea Scheller
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA State Statistical Office of the Republic of Macedonia	Ms. Blagica Novkovska
TURKEY Turkish Statistics Institute	Mr. Ali Can
UNITED KINGDOM Department for Environment, Food and Rural Affairs	Mr. Stephen Hall
INTERNATIONAL LABOUR ORGANIZATION Bureau of Statistics	Mr. Sylvester Young
UN DEPARTMENT FOR ECONOMIC AND SOCIAL AFFAIRS Division for Sustainable Development	Ms. Mary Pat Silveira
UN ECONOMIC COMMISSION FOR EUROPE Statistical Division	Ms. Lidia Bratanova Ms. Tiina Luige Ms. Vania Etropolska
UNITED NATIONS MISSION IN KOSOVO Statistical Office of Kosovo	Mr. Avni Kastrati
WORLD TRADE ORGANIZATION Research and Analysis Division	Mr. Hubert Escaith

WORLD BANK Environment Department	Mr. Kirk Hamilton
EUROSTAT Eurostat D1 - Key indicators for European policies	Mr. Pascal Wolff Ms. Laure Ledoux
EUROPEAN COMMISSION DG Environment DG Information Society and Media DG Economic and Financial Affairs	Mr. Oliver Zwirner Mr. Carlos Rodriguez Casal Ms. Geneviève Galloy Mr. Mark Hayden Ms. Ariane Labat
OECD Sustainable Development Environmental Directorate	Ms. Candice Stevens Ms. Tone Smith Mr. Marco Mira D'Ercole

ANNEX 3

TERMS OF REFERENCE, WORK PLAN AND CLARIFICATION OF MANDATE FOR THE JOINT UNECE/OECD/EUROSTAT WORKING GROUP ON STATISTICS FOR SUSTAINABLE DEVELOPMENT (WGSSD)

I. TERMS OF REFERENCE

(CES/ECE/BUR.2005/12 Rev., approved by the Bureau of the Conference of European Statisticians (CES) in October 2005)

A. Introduction

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.

B. Proposal

The working group should:

(a) 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;

(b) Identify the broad domains that good indicator sets should span;

(c) Develop a menu of good sustainable development indicators in order to help governments and international organizations when they are designing indicator sets;

(d) Identify a small set of indicators from the menu that might become the core for international comparisons;

(e) 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);

(f) Discuss the relationship between integrated environmental and economic accounts and sustainable development indicators.

The working group will be a joint working group of the OECD and the UNECE Conference of European Statisticians chaired by Robert Smith from Statistics Canada. 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.

II. WORK PLAN FOR THE WORKING GROUP ON STATISTICS FOR SUSTAINABLE DEVELOPMENT

(CES/ECE/BUR.2006/17 Add.1, approved by the CES Bureau in February 2006)

A. Background

As mandated in the Terms of Reference for the Working Group on Statistics for Sustainable Development, the proposed work plan with milestones for WG is submitted for consideration by the Bureau at its February 2006 meeting.

This work plan should be considered as preliminary since it has not been discussed yet with the Steering Committee. Its purpose is to give the Bureau a general sense of the Working Group's objectives and timeline. It should not be seen as definitive. The final version of the work plan will be agreed to when the Steering Committee meets in Paris in March. It should be noted that the "final report" referred to below is the "book" that has been discussed as the concrete output of the WG.

B. Workplan and timetable

(a) Establishment of Working Group – April 2006;

(b) Develop draft outline for final report of the Working Group – April 2006;

(c) Articulate a broad conceptual framework for sustainable development measurement – September 2006;

(d) Identify the broad domains that good indicator sets should span – Sept 2006;

(e) Develop a menu of good sustainable development indicators in order to help governments and international organizations when they are designing indicator sets – September 2006;

(f) Identify a small set of indicators from the menu that might become the core for international comparisons – September 2006;

(g) Identify basic data systems necessary for a small set of indicators and identify their possible sources – September 2006;

(h) Discuss the relationship between integrated environmental and economic accounts and sustainable development indicators – September 2006;

(i) International conference on measurement of sustainable development in Oslo – October 2006;

(j) Prepare interim report to CES Bureau with preliminary recommendations – April 2007;

(k) Review first drafts of chapters for final report – April 2007;

(l) Present interim report to CES Bureau – June 2007;

(m) Review revised drafts of chapters for final report – August 2007;

(n) Present draft final recommendations to OECD Annual Meeting of Sustainable Development Experts – October 2007;

(o) Submit final report – December 2007.

III. CLARIFICATION OF THE MANDATE OF THE GROUP

(ECE/CES/BUR.2006/OCT/26, Paragraph 18)

At the request of the Working Group, the CES Bureau further clarified the mandate at its October 2006 meeting. In conclusion, the Bureau agreed that:

(a) 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 was encouraged to go only as far as it can in a conceptually sound manner;

(b) 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.

ANNEX 4

TERMS OF REFERENCE FOR THE STEERING COMMITTEE OF THE WORKING GROUP ON STATISTICS FOR SUSTAINABLE DEVELOPMENT[24]

I. BACKGROUND

At the second meeting of the 2005/2006 CES Bureau, 24-25 October 2005, Washington D.C., the creation of a join 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.

II. OBJECTIVES OF THE STEERING COMMITTEE

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.

III. COMPOSITION OF THE STEERING COMMITTEE

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.

IV. MEETINGS OF THE STEERING COMMITTEE

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.

V. OUTPUTS

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.

[24] ECE/CES/BUR/2006/17, approved by the Bureau of the Conference of European Statisticians in February 2006.

VI. TIME FRAME

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

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