Statistics Netherlands

Division of Macro-economic Statistics and Dissemination
Development and support department

WELFARE MEASUREMENT IN A NATIONAL ACCOUNTING FRAMEWORK

Anna Kulig, Hans Kolfoort and Rutger Hoekstra

Summary: The objective of this paper is to propose a set of strategies which will enable Statistics Netherlands to produce indicators for sustainable welfare. All strategies are based on the National Accounts and its satellite accounts because they produce mutually consistent indicators. The paper starts off by providing the definitions of welfare, well-being and sustainability. The paper then provides an extensive literature review of the different approaches and methods. Furthermore, the strategies adopted by other countries and international organisations are summarized. Finally, this paper proposes three strategies which may be adopted by Statistics Netherlands to produce a set of indictors for sustainable welfare.

Keywords: GS, MEW, ISEW, GPI, SNBI, HDI, Sen's capability approach, SNI, ISS, critique GDP, indicator sets, sustainable development, capital approach, national wealth, welfare, well-being, happiness, GDP, NI, GNI, economic growth, SAM, NAMEA, SESAME, DPSIR, composite indicators

Project number: *MOO-204752*
BPA number: *2007-150-MOO*
Date: *3 October 2007*

Contents

1. Introduction 3

2. General background 4

2.1 Definitions of some core terms 4

2.1.1 Welfare 4

2.1.2 Well-being 4

2.1.3 Sustainable development and sustainability 4

2.1.4 GDP and other national accounting aggregates 5

2.2 Critique with respect to GDP 5

2.3 Summary of relevant work by Statistics Netherlands 7

2.3.1 Social Accounting Matrix (SAM) 8

2.3.2 National Accounting Matrix including Environmental Accounts (NAMEA) 9

2.3.3 System of Economic and Social Accounting Matrices including Extensions (SESAME) 10

2.4 International context 10

2.4.1 Working Group on Sustainable Development Indicators (Eurostat) 10

2.4.2 Working Group on Statistics for Sustainable Development (WGSSD) (UNECE/OECD/Eurostat) 11

2.5 Overview of indicator approaches and methods 11

2.5.1 Overview 11

2.5.2 Composite indicators 12

2.5.3 Indicator sets 18

2.6 Indicators used by other countries 22

3. Possible strategies for Statistics Netherlands 24

3.1 Hybrid capital approach 24

3.2 Policy based approach 25

3.3 SDI sets in Dutch National Accounts setting 26

3.3.1 International comparison 26

3.3.2 Eurostat SDI's 27

3.3.3 SDI sets of individual countries 27

3.3 Summary of the proposed strategies 28

4. Conclusions 30

5. Appendices 31
5.1 Appendix 1. Description of indicators in other countries..... 31
5.2 Appendix 2. Indicators other countries and international organisations . 35
5.3 Appendix 3. Additional literature..... 39
References..... 43

1. Introduction

One of the main products of statistical institutes is the National Accounts (NA), which represents the official statistical overview of the national economy. They provide the framework for preparing, discussing and evaluating economic and monetary policy. The system is based on international agreements about definitions, measurement and classifications, which are documented in the 'System of National Accounts' (SNA) (United Nations, 1993) and related handbooks such as the 'European System of Accounts' (ESA) (Eurostat, 1996).

The NA system yields macro-economic aggregates, of which GDP is well-known and widely used. However, GDP is controversial, particularly because it has a long history of being used as an indicator for (social) welfare. This practice has been criticized, correctly according to Statistics Netherlands[1], for many decades (see for example van den Bergh, 2006). The SNA (section 2.178) mentions that 'neither gross nor net domestic product is a measure of welfare. Domestic product is an indicator of overall production activity'.

The SNA distinguishes a core system but also leaves open the possibility of tailor-made satellite accounts which contain additional information in areas for which the core system is inadequate. These satellite accounts sometimes introduce additional classifications or definitions, but indicators remain consistent with the core system. The satellite accounts for the environment are probably best known (SEEA, 2003; Milieurekeningen, 2006).

Although satellite accounting is increasingly adopted, it has not yet been applied to broad topics such as "welfare", "sustainability" or "well-being" which play an important role in many policy debates, scientific publications and social discussions. For that reason it is useful for Statistics Netherlands to explore a conceptual framework, based on satellite accounting, which produces a set of indicators for the above mentioned topics.

This paper provides an overview of the relevant scientific and policy literature, as well as practices in other countries and international organizations. The paper identifies three strategies which may be followed by Statistics Netherlands to come to a set of indicators based on satellite accounts.

This paper is structured as follows. Section 2 provides an overview of the relevant literature: definitions of the core concepts (2.1), criticisms of the use of GDP as a welfare indicator (2.2), summary of work on measuring of welfare done by Statistics Netherlands (2.3), the international context (2.4), overview of indicator approaches and methods (2.5) and work in other countries (2.6). Section 3 proposes three strate-

[1] The annual publication of the National accounts includes a comment to users not to use GDP as a measure of social welfare (Statistics Netherlands, 2006).

gies which may be adopted by Statistics Netherlands. Conclusions are drawn in section 4.

2. General background

The concepts of welfare, well-being and sustainable development which underlie this report are not well-defined. It is beyond the scope of this paper to bring clarity to the abundant literature on these issues. Nevertheless, in this section we will provide a brief definition of these terms.

2.1 Definitions of some core terms

2.1.1 Welfare

Welfare refers to disposal of goods and services (Veenhoven and Timmermans, 1998) or to the satisfaction of needs by means of scarce goods and services (Marijs and Hulleman, 1998).

2.1.2 Well-being

Well-being generally refers to an individual being well, happy or prosperous (Van de Ven et al., 2000). Well-being also refers to the state in which a person is prosperous and happy both in a material and in a mental way. Well-being alludes to the extent of perception of happiness by people in a society (Marijs and Hulleman, 1998).

2.1.3 Sustainable development and sustainability

The well-known 'Brundtland-Commission' defines '*sustainable development*' as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission Report, 1987). It comprises an economic, an environmental and a social dimension.

Sustainability is defined as the capacity to provide non-declining future welfare (Neumayer, 1999). It is often operationalized by defining different forms of capital such as man-made capital, human capital, natural capital and social capital (Figge and Hahn, 2004). Often a distinction is made between weak and strong sustainability. Weak sustainability[2] assumes that the total capital stock is non-declining. So, weak sustainability allows substitution of a natural capital, man-made, human and social capital. Strong sustainability assumes that each different type of capital is

[2] In SEEA (2003) weak sustainability is defined as follows: *Weak sustainability* seeks to maintain from year-to-year the per capita income generated from the total capital stock available to a nation (measured in monetary terms). No regard is given to the composition of this stock, as it is assumed that all forms of capital are substitutes for one another. Weak sustainability clearly allows for the depletion or degradation of natural resources, so long as such depletion is offset by increases in the stocks of other forms of capital (for example, by investing royalties from depleting mineral reserves in factories).

non-declining.[3] If one of the capital stocks declines it can therefore not be compensated by an increase in another.

2.1.4 GDP and other national accounting aggregates

Gross Domestic Product (GDP) is a measure of overall production activity. It can be measured in three ways. It is defined as total value added of all industries plus the balance of taxes and subsidies on products plus the difference between imputed and paid VAT. This is the so called *production approach* of GDP. In addition to this approach the *expenditure approach* exists, in which domestic production of goods and services, intended for consumption, capital formation and export is represented. Finally, GDP also is equal to the income from the domestic production process. This is the *income approach*.

The volume growth of GDP is usually referred to as *economic growth*.

In current prices Gross National Income (GNI) equals GDP plus net primary income from the rest of the world. GNI minus depreciations is Net National Income and is usually referred to as *National Income*.

2.2 Critique with respect to GDP[4]

In the past many economists have used GDP for the measurement of welfare. However, GDP (or related concepts such as GNP and NI) are good indicators for production, income, economic growth but not appropriate as a welfare measure. Moreover, GDP was never meant to measure welfare, because the concept of welfare is far broader than economic production only. GDP, for example, does not account for social and ecological costs. Besides, contributions of e.g. household and volunteer work to welfare are not taken into account in GDP.

In this section the main arguments against GDP as a welfare indicator are summarized:

I. The first one refers to lexicographic preferences which are defined by two characteristics:
   - ❖ people have limited needs with respect to certain services and goods at a certain consumption level;
   - ❖ 'lower' needs (e.g. the removal of hunger) have to be fulfilled before 'higher' needs (e.g. recreation) can appear.

---

[3] SEEA (2003) defines strong sustainability in the following manner: *Strong sustainability* requires that all forms of capital be maintained intact independent of one another. The assumption implicit in this interpretation is that different forms of capital are mainly complementary; that is, all forms are generally necessary for any form to be of value. Produced capital used in harvesting and processing timber, for example, is of no value in the absence of stocks of timber to harvest. Only by maintaining both natural and produced capital stocks intact, the proponents of strong sustainability argue, can non-declining income be assured.

[4] This section has been mainly based on the article of Jeroen van den Bergh 'Abolishing GDP', 2006.

Within this framework income growth and associated growth of material consumption (e.g. in polluted environments) is thus an imperfect compensation for a lack of satisfaction of basic needs such as clean water. Individual and social welfare can remain constant or even decline while GDP and the individual income increase.

II. The second argument against GDP concerns subjective welfare and happiness. Subjective well-being studies also show that, at the individual level, welfare does not depend only on income (there is no perfect correlation between income and welfare) (Easterlin, 2001; Frey and Stutzer, 2002; van Praag and Ferrer-i-Carbonell, 2004; Ferrer-i-Carbonell, 2005). Other income-independent factors such as having a partner (and stable family), being healthy or having friends, influence individual welfare or happiness.

   Hence, if income does not exhibit a reliable and robust relationship to happiness at the micro-level, then it is extremely unlikely that the aggregation of individual incomes in a GDP provides a good indicator of social welfare at the national level.

III. The third argument concerns income distribution, relative welfare and rivalry. The GDP per capita indicator stresses average income. An unequal distribution implies unequal opportunities for personal development and well-being. However, GDP per capita does not distinguish between the expenditures of the poor on basic goods and of the rich on luxury goods. Another related aspect of distribution is that individual welfare cannot be separated from the welfare of other individuals in the relevant social environment ('peer group'). Therefore, the term 'relative welfare' or 'context dependent preferences' is used (Tversky and Simonson, 2000). Such preferences are characterized by an urge to compare oneself with others and rivalry. Subjective well-being research has shown that poverty often means that individuals are unhappy because they can consume much less than the majority of individuals in their social environment. Consumption surely is not only driven by needs in general but also by imitation and search for status.

IV. This argument against GDP regards formal versus informal economy. In general, GDP covers only activities and transactions that have a market price and completely neglects informal transactions between people that occur outside formal markets (such as voluntary work, household work, and child care). The fact that the informal economy is left out of consideration explains why GDP per capita for many countries can be extremely low. At the same time, it can easily give a wrong picture of how happy people really are. GDP cannot serve as a measure to judge the welfare impact of fundamental changes that involve transitions of the informal to the formal economy. The expansion of markets to include informal activities is not always good for social welfare, even if GDP is raised.

V. The next argument concerns the principles of proper accounting. The use and calculation of the GDP indicator is inconsistent with some of the principles of

good bookkeeping. For instance no clear division between costs and benefits is made. In order to make it more clearly a simple example will be given. Increase of the number of traffic accidents can be seen by the majority as a decrease in welfare. In spite of this the GDP will be still growing because of the increase in the production of the ambulance services.

VI. Macroeconomics, and in particular economic growth theory, is concerned with the dynamic aspects of the economy as a whole and it does not offer any support for the idea that GDP can serve as a measure of social welfare. This is consistent with the most recent 'System of National Accounts' (United Nations, 1993) where in paragraph 2.178 is written 'Neither gross nor net domestic product is a measure of welfare. Domestic product is an indicator of overall production activity.'

VII. A general shortcoming of GDP as an indicator of social welfare has to do with its aggregated character where the production activities that have negative effects on the welfare still lead to the growth of the GDP. For example industry that provides a lot of pollution make people sick what leads to a decrease in perceived welfare. Nevertheless, both the production coming from this industry as well as medical help are added as positive activities to the GDP.

VIII. Furthermore, another important argument against GDP as a welfare indicator concerns the fact that there is no deduction made with respect to the harmful external effects on environment that were caused by production of goods and services. The defensive costs are counted as positive. These costs include expenditures on the environmental protection and on treating damage from a polluted environment created by economic activities (SEEA, 2003). Thus, if air, water or natural areas are being polluted, any damage does not enter GDP, but when pollution is being cleaned this increases GDP (United Nations, 1993).

IX. The last argument relates to the natural environment and resources. This involves goods and services delivered by nature. The (capital) depreciation associated with environmental changes (fish stocks, forests, biodiversity) and depletion of resource supplies (fossil energy, metal ores) is missing from the GDP calculation. However a correct economic welfare approach would only characterize changes as real progress (welfare improvement) if they are accompanied by a sustainable use of environment and nature what was already recognised by Hueting (1974).

2.3 Summary of relevant work by Statistics Netherlands

Policy makers, economists and others often use GDP as an indicator of the welfare of a society. However, welfare and the broader term well-being depend on more aspects than economic performance alone and therefore benefits from a multidimensional approach. The SNA not only provides a systematic overview of economic performance but also of social, environmental and other factors. Satellite accounts

play an important role in this. This chapter provides an overview of the work on the measurement of welfare and well-being which has been undertaken at Department of National Accounts of Statistics Netherlands.

2.3.1 Social Accounting Matrix (SAM)

A Social Accounting Matrix (SAM) includes information on the relation between persons, households and the economy (Timmerman and Van de Ven, 1994). For the compilation of the SAM, three statistical systems have been used: the national accounts, the labour accounts and the socio-economic accounts and they have been combined in such a way that the resulting system is consistent with the national accounts figures (National accounts of the Netherlands 2005, 2006). A SAM is very relevant for the measurement of welfare as it contains detailed information on employment, distribution of income and expenditure of income presented by household and employment categories (van de Steeg et al., 2006).

In the SAM, labour input and compensation of employees have been subdivided by gender and seven levels of education. Furthermore, income generated by production of goods and services, other payments and receipts of income, consumption expenditure and saving are described for fifteen household groups. In the Dutch case, the grouping of households has been based on main source of income (wages and salaries, entrepreneurial income, or transfer income), and composition of the household (single-person households, and multi-person households with/without children). As a consequence, the labour market and aspects of income distribution can be directly related to the economic process. In the near future, other or more detailed breakdowns will become available.

Some distinguishing features of a SAM are:

- its incorporation of both the supply and demand side of actual labour markets (on which persons and not households operate);
- its emphasis on the interrelations between economic processes (so that both ends of all transactions are shown), which makes it quite expedient for economy-wide modelling and analyses.

Although a SAM provides a useful insight into the functioning of an economy, it is still incomplete as a framework for a comprehensive analysis of welfare because a SAM is fully expressed in monetary units, whereas (changes in) attributes of well-being are typically measured as (changes in) non-monetary units (van de Ven et al. 2000).

The SAM contains a large amount of detailed socio-economic information, in which it offers a much better understanding of the interrelations between the transactions of a large number of household groups, product groups, industries and the like (Statistics Netherlands, 2006).

2.3.2 National Accounting Matrix including Environmental Accounts (NAMEA)[5]

In the Netherlands the central framework of the National Accounts has been extended with environmental accounts, which is updated annually. The Dutch environmental accounts are compiled according to the definitions of the national accounts and the guidelines of the international System of Integrated Environmental and Economic Accounting (SEEA, 2003). Accordingly, the data from the environmental accounts are internationally comparable. The systematic presentation of information on the environment and economy facilitates an objective analysis of economic and environmental policy issues. The sustainability of well-being and its progress are closely linked to the environment.

Not only pollution caused by producers and consumers is shown, but also the entry of polluting substances in the Dutch environment: the domestically emitted pollution including the balance of cross-border pollution from and to the rest of the world. Cross-border pollution exists of two different parts:

- pollution by non-residents in the Netherlands or by residents abroad;
- supply and removal of pollution by surface water or air.

Because of the differences in concepts, the data of the environmental accounts can differ from other environmental and energy statistics.

At present, a wide variety of different environmental accounts are produced by Statistics Netherlands. The air emissions accounts cover environmental information on climate change (emission of greenhouse gasses), ozone layer depletion, acidification, and local air pollution. In the energy accounts the supply and use of energy products is shown both in physical and monetary terms. The waste accounts record the production of 70 different kinds of solid waste and how these are treated. The water accounts (NAMWA, national accounting matrix including water accounts) include both the production and consumption of water (tap water, groundwater, surface water), as the emission of hazardous substances to water (heavy metals, nutrients, pesticides etc.). The Dutch environmental accounts also include some monetary accounts related to environmental subjects, namely the environmental expenditure accounts and the environmental tax accounts. Finally, monetary and physical accounts are combined in the NAMEA-matrix (National accounting matrix including environmental accounts).

The range of Dutch environmental accounts will be expanded in the next few years. New work will be undertaken with regard to material flow accounts (MFA), subsoil accounts for oil and gas reserves, and integrated asset accounts for land in physical and monetary units Also the monetary accounts will be extended with respect to environmental subsidies and the environmental goods and services sector. Finally, the data from the environmental accounts will be used to do some detailed environ-

[5] We would like to thank Sjoerd Schenau (Statistics Netherlands, sector National Accounts) for his helpful comments on this section.

mental-economic analyses (structural decomposition analysis, impact analysis, IO-analysis, etc.).

2.3.3 System of Economic and Social Accounting Matrices including Extensions (SESAME)

The SESAME approach can be defined as a detailed and integrated statistical information system in matrix format from which a set of core (macro-) indicators for different aspects of welfare and well-being can be derived (Keuning, 1997). Such a summary typically describes trends in main indicators: e.g. Gross Domestic Product (GDP), population size, (un)employment, inflation, income inequality, environmental indicator(s), unpaid household and volunteer activities, average income in the poorest subgroup, average number of years of schooling, average expenses on health, average number of victims from crime (van de Ven et al. 2000).

In essence, SESAME meets the concern already expressed in a 1977 United Nations' report: "It is recognised by all that it is not practicable to make a direct measure of the welfare of a community in monetary or in any other terms. The best that can be done is to measure a number of factors that are generally supposed to contribute to or detract from welfare, not forgetting that the distribution of the aggregate among individuals may be as important from the welfare point of view as the aggregate itself."

The central framework extended with the NAMEA and SAM form the foundation of the SESAME (Kazemier et al, 1999; Van de Ven et al, 2000; De Haan et al., 2002).

2.4 International context

2.4.1 Working Group on Sustainable Development Indicators (Eurostat)

The main goal of Eurostat Working Group on Sustainable Development Indicators is to establish an indicator list consistent with the Sustainable Development Strategy adopted by the Gothenburg European Council in June in 2001 and to gather the data from all Member States. The European Commission agreed to a set of sustainable development indicators in February 2005. By the end of 2007 a new report will be published, together with the reviewed list of indicators. The aim is to reduce the total number of indicators to 120 as compared with 155 indicators from 2005.

The monitoring report is preliminary aimed at providing a first progress report on the current state of play in the implementation of the strategy. It also describes the set of indicators for monitoring the implementation of the strategy. The trends derived from the analysis of indicators are assessed against policy objectives to inform general public and decision-makers about achievements, trade-offs and failures in attainment the commonly agreed objectives of sustainable development

The SDI set is organised as a three-level pyramid:

- Headline indicators monitoring the 'overall objectives' of the SDS are at the top of the pyramid. They are characterized by robustness and availability with reasonably long time series (at least 5 years).
- The second level of the pyramid consists of indicators related to the operational objectives of the SDS
- The third level consists of indicators related to the actions explicitly mentioned in the SDS or to other issues that are necessary to analyse progress towards objectives. Also breakdowns of level 1 and 2 indicators are present at level 3.

The set of SDI's indicators consisted up to now of 12 headline, 45 core policy and 98 analytical indicators. SDI set forms a basis for regular monitoring of progress in the headline objectives of the SDS. A majority of the level 1 and 2 indicators (86%) address more than one dimension and 33% can be considered as three dimensional, addressing economic, social and environmental aspects simultaneously. The main weakness concerns the lack of indicators measuring both environmental and social dimensions. With respect to the general structure the indicators are divided into 10 themes and further into sub themes.

2.4.2 Working Group on Statistics for Sustainable Development (WGSSD) (UN-ECE/OECD/Eurostat)

The WGSSD is a joint working group which was initiated by the UN-ECE, OECD and Eurostat. Its aim is to "articulate a broad conceptual framework for sustainable development". It has explicitly been asked to investigate the possibilities and limits of the "capital framework" as a conceptual system for statistics for sustainable development.

The WGSSD is split into 2 sub-groups. The first group will investigate the conceptual aspects of the capital approach in general. However, this group will also tackle complex issues such as human and social capital, for which concepts are less well defined as economic and natural capital. The second group will try to link the set of indicators which are produced by policy cycles (such as the WGSDI) to the capital framework.

The WGSSD will present its final report around June 2008.

2.5 Overview of indicator approaches and methods

2.5.1 Overview

In table 1 the various approaches and methods used to produce indicators (sets) for welfare are divided into two main parts: composite indicators and sets of indicators. In the former approach a single indicator is used as an indication of welfare (for description see section 2.5.2). Six of these approaches can be considered as methods

that provide corrections of the National accounts aggregates. Besides, the description of three other approaches is given.

Table 1. An overview of approaches

Composite indicators	Corrections of National Accounts aggregates	Monetary Capital Approach (Genuine Savings)	
		Measure of Economic Welfare (MEW)	
		Index of Sustainable Economic Welfare (ISEW)	
		Genuine Progress Indicator (GPI)	
		Sustainable Net Benefit Index (SNBI)	
		Sustainable National Income (SNI)	
	Other approaches	Human Development Index (HDI)	
		Sen's Capability Approach	
		Index for a Sustainable Society (ISS)	
Set of indicators	Policy-based approach		
	Model-based approach	Dimensions	Economic dimension
			Social dimension
			Environmental dimension
		DPSIR	Driving Force
			Pressures
			State
			Impact
			Response
		Hybrid Capital Approach	Economic capital
			Natural capital
			Human capital
			Social capital

The 'sets of indicators' approaches on the other hand (for description see section 2.5.3) are based on the idea that one figure for sustainable welfare is not satisfying because welfare is a multidimensional and complicated phenomenon, which needs a set of indicators to describe its different dimensions. We distinguish policy-based approaches and model-based approaches. The last mentioned approaches are divided in three frequently used models: based on classical dimensions of sustainability, the so called DPSIR-method and the (hybrid) capital approach.

2.5.2 Composite indicators

One approach to measure welfare is the so called composite indicator approach (also referred to as one-number approach indicators). These indicators combine information about a number of aspects in order to provide a single (usually monetary) measure of progress. Due to the rising criticism of the use of GDP as a welfare indictor, many of these indicators were developed in order to correct GDP in some way. In this subsection a brief outline of six modifications of the GDP (or other aggregates from the national accounts) will be provided. Additionally we will provide short descriptions of three other indicators that are discussed regularly in the literature.

a. Monetary Capital Approach (Genuine Savings)

The 'Genuine Savings' (GS) has been developed and used by the World Bank as a central indicator of sustainability. The World Bank states that "policies leading to the persistently negative genuine saving are unsustainable" (The World Bank, 2006).

The GS indicator is derived from modifications to the measure of savings in the existing accounts. In addition to making allowance for the depletion of energy, minerals and forests and for environmental damage caused by carbon dioxide emissions,

an adjustment is also made for education expenditure, which is taken to be an important contributor to increases in human capital (SEEA, 2003).

It is noteworthy that the GS indicator incorporates several environmental aspects. However, the value of depletion of natural resources and the costs associated with pollution damage are very difficult to estimate.

The 'Genuine Savings' indicator corresponds to the weak sustainability concept as it allows for substitution of natural resources by produced and human capital (Hartwick, 1977). Losses of natural capital are not regarded as problematic as long as they are compensated by economic and human capital. Thus a positive value of genuine savings approach does not always imply environmental sustainability

b. Measure of Economic Welfare (MEW)

The MEW constitutes the first version of modified National Income and was constructed by Nordhaus and Tobin (1973) in order to reflect economic welfare more completely. Three kinds of modifications were introduced. First of all, expenditures with regard to health care and education were treated as investment in human capital whereas expenditures on police and on defence were treated as 'intermediate' thus not in themselves generating welfare (Lintott, 1996). Second of all, items with regard to the services of capital goods such as durable consumer goods or leisure time were added. Finally, costs of urbanisation were subtracted.

The SNA defined MEW as an adjusted measure of total national output, including only the consumption and investment items that contribute directly to economic well-being, calculated as additions to gross national product (GNP), including the value of leisure and the underground economy, and deductions such as environmental damage.

c. Index of Sustainable Economic Welfare (ISEW)

Daly and Cobb developed (Daly and Cobb, 1989) the Index of Sustainable Economic Welfare (ISEW) in order to provide a more reliable monetary indicator of economic welfare and sustainability (Neumayer, 1999). The ISEW was supposed to provide a remedy for a couple of aspects neglected by the GDP. This was accomplished by adding to GDP services that it omits, while deducting GDP categories that do not directly provide services to consumers. Moreover the ISEW was meant to replace/adjust the MEW because the latter did not include environmental concerns with regard to sustainability. Therefore depletion of natural capital and pollution were taken into account and this required valuing non-renewable capital. Daly conceptualised this valuation as "the amount of rent from resource production that should be reinvested in a process that would create a perpetual stream of output or a renewable substitute" (Cobb, J, 1998).

Additionally, the ISEW comprises corrections neutralizing income inequality and the unsustainability of production and consumption. In particular, the ISEW adapts:

- GDP for non-market goods and services;
- defensive costs of social and environmental protection and repair (health expenditure, costs of road accidents, costs of urbanization);
- reduction of future welfare caused by present production and consumption (loss of natural areas, loss of soil, depletion of non-renewable resources, air and water pollution, greenhouse effect);
- the costs of efforts to obtain the present welfare level (commuting, advertising, duration and intensity of work);
- the distribution of income and labour (inequality among workers, between employed and unemployed, between males and females).

The ISEW has become a measure of economic welfare and sustainable development (van den Bergh, 2006). It begins, like the MEW, with personal consumption, which assumes that the more individuals consume, the better their economic welfare. This could imply a high correlation between consumption and welfare. However, the results of Cobb's and Daly's study showed that whereas the GDP followed a rising trend, the ISEW showed a constant or even decreasing pattern after a certain time (Cobb, J. 1998).

Although the ISEW includes the costs of environmental damage and natural capital depletion and constitutes a measure of economic welfare, it does not imply a measure of the sustainability of the economic welfare (Bleys, 2006). Furthermore the ISEW is criticized for the high amount of subjectivity with regard to the assumptions made by the researcher during the incorporation of the items in the index. The assumptions concerning the weighting of income distribution, the valuing of the depletion of non-renewable resources and long-term environmental damage are rather arbitrary and if they are not clearly communicated, high risk of misinterpretation is present (Bleys, 2006; Neumayer, 1999). The ISEW corrects many aspects of GDP but restricts itself to economic aspects (van de Kerk, 2006). Neither GDP nor the ISEW give a complete picture of the society because they do not include social indicators such as subjective well-being measures or social summary index (Bleys, 2006).

d. Genuine Progress Indicator (GPI)

The GPI deviates slightly from the ISEW in terms of the specific categories of corrections included.

Firstly, GPI includes the following monetary benefits that were ignored by the GDP: volunteer work and the value of time spent on household work, parenting, the value of services of consumer durables (e.g. cars) and the services of highways and streets. Secondly the GPI deducts three important categories of expenses that detract from the nation's well-being: defensive expenditures, defined as money spent to maintain the household's level of comfort, security, or satisfaction, further social costs, such

as the cost of divorce, crime or loss of leisure time and finally depreciation of environmental assets and natural resources.

Both ISEW and the GPI suggest that the costs of economic growth now outweigh the benefits, leading to "growth that is uneconomic" (paraphrasing Herman Daly in van den Bergh, 2006).

e. Sustainable Net Benefit Index (SNBI)

In the critiques on the use of GDP as an indicator for welfare one of the arguments is that in calculating GDP poor bookkeeping is exhibited because no distinction is made between costs and benefit. This is the first aspect which is tackled in the construction of the SNBI. Two separate accounts are produced, one for 'uncancelled' benefits of economic activity and one for the 'uncancelled' costs of economic activity (Lawn and Sanders, 1999). Examples of these benefits are services yielded by museums and libraries, services from volunteer work; examples of these costs are noise pollution, resource exhaustion and biodiversity loss. The SNBI is defined as the difference between the two variables.

f. The Human Development Index (HDI)

The Human Development Index (HDI) was developed in 1990 by the United Nations (Matthews, 2006). The three main dimensions of HDI are aggregated via an unweighted average. Those three dimensions capture relevant aspects of human well-being:

- Longevity- measured by life expectancy at birth as a proxy for health achievement
- Knowledge- measured by adult literacy rate combined with gross educational enrolment ratio (for primary, secondary, and tertiary schools) as a proxy for educational attainment
- Standard of living- measured by GDP per capita in purchasing power parity U.S. dollars

Although the HDI was developed to measure empowerment and not welfare, United Nations implicitly assumed that enlarging people's choices will enhance people's (future) well-being, however an important addition is that human beings should not merely be looked upon as beneficiaries, but also as agents of chance in the development process (van de Ven et al., 2000).

The HDI has been criticised from the start. Firstly, the lack of measures of freedom and/or human rights was noted. Also quality of data and data availability as well as changes in distribution of income appeared to be a cause for concern. Moreover the three basic indices are added together to form the HDI, thereby making health, education and income equal substitutes. Finally, HDI does not cover the (environmental) capital. Consistent with Desai (1995) and Neumayer (2001) resource exploitation and the environmental degradation should be taken into account when devel-

oping the HDI because it would enable to check whether a country is 'mortgaging the choices for future generations'.

g. Sen's Capability Approach

Amartya Sen developed a conceptual framework that deals with human capability and freedom. He considers the development of a country as the expansion of people's capabilities. Sen argues that neither opulence (income, commodity command) nor utility (happiness, desire fulfilment) constitute or adequately represent human well-being and deprivation.

Sen's Capability Approach (Sen, 2007) evaluates social states in terms of human well-being in which the emphasis is on so called functional capabilities. The Capability Approach has been very influential in development policy and in social sciences. One of the most important advantages is its flexibility, because Sen does not subscribe it to a fixed list of capabilities. This allows researchers to apply it in different ways. However, this could also be a disadvantage: how to operationalize the framework, what are valuable and important capabilities? Clark (2005) mentioned that Nussbaum (2000), for instance, has tried to complete the approach by answering this question. But other disadvantages remain, e.g. the usefulness of the approach for making inter-personal comparisons of well-being in the presence of potential disagreements about the valuation of capabilities including the relative weights to be assigned to these capabilities (Clark, 2005).

This approach contrasts with a common view that sees development purely in terms of GNP growth, and poverty purely as income-deprivation.

h. Sustainable National Income (SNI)

Sustainable National Income (SNI) has been developed by Roefie Hueting (1974 and 2007). SNI in the year of calculation is defined as the maximum attainable level of production whereby, with available technology in the year of calculation, vital environmental functions remain available for years to come. This is contrary to the 'formal' national income in which the loss of environmental functions is not taken into account. Environmental functions are defined as the possible uses of our non-human made physical surroundings, on which humanity is entirely dependent in its entire doings, whether they be producing, consuming, breathing or recreating.

Evaluating the development of a country attention is paid to the distance between 'formal' national income and SNI. Due to the fact that the SNI is by definition lower than the 'formal' national income, an increasing distance implies more sustainability.

In pointing to the advantages and disadvantages of the SNI, van den Bergh (2006) has formulated it as follows: SNI has the advantage of taking into account general equilibrium effects of corrections but the disadvantage of restricting itself to environmental and natural resource issues.

i. Index for a Sustainable Society (ISS)

The ISS is an index which is based on 5 categories: Personal Development, Clean Environment, Well-balanced Society, Sustainable Use of Resources and Sustainable World. It integrates the most important aspects of quality of life and sustainability in an understandable way.

The five categories contain 22 indicators in total. The values of these indicators are between 0 (no sustainability or quality of life) and 100 (perfect sustainability or quality of life). The indicators have been calculated with specific mathematical formulas, after which with weights for each indicator the categories are calculated (values between 0 and 10). Finally, weights for the categories are assessed to reach the ISS (Netherlands number 12 with value 6.2, Norway first with 7.0).

The first report about ISS (every two years a new report will be published) provides data for 150 countries.

In the ISS economic factors do not play an important role. The way of determining the weights of the indicators and the categories also constitutes a disadvantage as it is a rather arbitrary.

j. Summary of composite indicators

In this section we have provided a summary of the alternatives of GDP. However, none of these measures has been fully accepted as measure of welfare in the literature or in practice. The reason is that no consensus exists about which aspects should and should not be included in a 'composite indicator approach'. For instance, regarding the ISEW, Stockhammer et al. (1997) argued that the most important critique is that welfare is a multidimensional phenomenon and cannot be reduced to one dimension. In our view this applies for all alternatives regarding the GDP. Lawn (2003) emphasizes that ISEW and GPI require more robust monetary valuation in order to arrive at acceptable indicators.

In the case of indicators such as the HDI and ISS different aspects possess different measuring units and any choice of weights is rather subjective and should, in our view, be made by politicians, not by statisticians.

Table 2 shows which aspects are covered by the composite indicators (excluding Sen's Capability Approach as it deviates too much from the others). In this table several aspects described in this section have been listed in the first column (categorised by four groups) in order to get a comparison between the composite indicators.

Table 2. Various aspects versus composite indicators

Aspects / Composite indicators	HDI	GS	MEW	ISEW	GPI	SNBI	SNI	ISS
Economical aspects								
GDP/National Income/Consumption	X		X	X	X	X	X	
Net saving rate/ foreign borrowings/net official transfers		X						X
Capital consumption		X					X	
Income distribution				X	X	X		X
Non market goods (housework, volonteer work)				X	X	X		
Defensive expenditure								
Costs of efforts to obtain the present level of welfare (police,defence, intensity of work)			X	X	X	X		
Defensive environmental costs (urbanisation, road accidents)			X	X	X	X		
Defensive social costs (health expenditure)		X		X	X	X		
Environmental costs								
Environmental damage (pollution)		X		X	X	X	X	X
Depletion of natural resources		X		X	X	X	X	X
Durable consumer goods			X		X	X		
Social aspects								
Leisure time			X			X		
Health (expenditure as an investment or life expectancy)	X		X	X	X	X		X
Education (expenditure as an invetsment or enrolment)	X	X	X	X	X	X		X

In section 2.2 the critique with respect to GDP as a welfare indicator are discussed. In order to check whether these arguments against GDP as a welfare indicator are covered by the existing alternatives (composite indicators) we have drawn up the table below (table 3).

Table 3. Arguments against the GDP versus composite indicator approach

	Arguments against the GDP / Composite indicator approach	HDI	GS	MEW	ISEW	GPI	SNBI	SEN'S CA	SNI	ISS
I	Lexicographic preferences									
II	Individual happiness and social welfare							X		X
III	Income distribution, relative welfare and rivalry				X	X	X	X		X
IV	Informal economy			X	X	X	X			
V	Principles of proper accounting									
VI	Concept of GDP									
VII	Aggregation		X		X	X	X			
VIII	Defensive costs and environmental externalities		X	X	X	X	X		X	X
IX	Depletion of natural resources		X		X	X	X		X	X

Table 3 shows that three out of the nine points of criticism with respect to GDP are not covered by any of the indicators included in the table. Moreover the HDI indicator covers none of the arguments against the GDP.

2.5.3 Indicator sets[6]

As opposed to composite indicators many countries and institutes have adopted indicator sets to monitor sustainable development or welfare. A number of countries base their indicator sets on their policy statements (policy-based approach). Other countries use a conceptual model (the model based approach). Examples include the dimensions of sustainability, the capital approach and the DPSIR-model.

[6] This section has been largely based on the working paper of Jullie Hass and Thorvald Moe "Challenges in establishing sustainable development indicators", Oslo 2006

In the tables below we have provided a short description of each approach as well as advantages and disadvantages of each method.

a. Policy-based approaches

In the policy-based approach indictors are selected on the basis of government policy on sustainability. Table 4 summarizes the characteristics, strengths and weaknesses of the policy-based approach.

Table 4. Policy-based approach

Policy-based approach	
Understanding meanings of the policy statements	
Establishment of the SD definition	
Identification of different policy topics and themes	
Selection of relevant indicators in alignment with the policy statement/target/goals	
Strengths	**Weaknesses**
High correspondence between the indicators and the policy relevancy	Problems with interpretation of political documents
Indicators can be created for multinational or geographic regions for which there is a policy document	Possibility that the political statements will not provide a comprehensive or theoretically robust definition of SD thus risk that incomplete or non-robust definition of SD will be used
	Political statements and policies can and most likely will change over time what can but not necessarily will lead to a change in the definition of SD and the corresponding indicators
	The instability of the indicators set can lead to problems when trying to track long-term trends since establishing the data required for the indicators can be costly and take time to establish

b. Model-based approaches: the dimensions of sustainability

The first type of model-based approach is based on the three dimensions defined by the Brundtland report. The characteristics, strengths and weaknesses of this approach are shown in table 5.

Table 5. Model-based approaches: the dimensions of sustainability

Model-based approach	
Economic dimension	
Environmental dimension	
Social dimension	
Strengths	**Weaknesess**
SD is defined by the model	The risk that the indicator will be less politically relevant and will not be used in connenction with implementing any policies regarding SD
What is to be to included and excluded is determined by the definitions of the model	In the quest to quantify SD through the use of the indicators certain assumptions are made when the indicators and related calculations are defined.
The model is theoretically robust and is characterised by a long-term perspective.	

c. Model-based approaches: the hybrid capital approach

The hybrid capital approach is basically the same as the monetary capital approach described in section 2.5.1 except that not all the forms of capital are monetarised. Table 1 shows the difference components of national wealth, while the strengths and weaknesses of the monetary capital approach are summarized in table 7.

Table 6. Model-based approaches: the hybrid capital model

Components of National Wealth						
Economic Capital		**Natural Capital**			**Human Capital**	**Social Capital**
Financial Capital	*Produced (Real) Capital*	*Natural Resources*	*Land and surface water*	*Eco-systems*		
money, shares	machines, buildings	fossil fuels: coal, oil and gas	hydro- and wind power	nature's absorptive capacity for waste products	health	citizens' confidence, social trust, norms
	urban land	minerals, sand and gravel	biodiversity: fish, birds		labour, know how, level of education	the value of institutions, social organisations and networks
		soil	forested land		competences, skills, experience	state of governance (freedom, choice)
monetary assessment (NA)	monetary assessment (NA)	monetary assessment (NA)	difficult to assess a monetary value	difficult to assess a monetary value	difficult to assess a monetary value	difficult to assess a monetary value

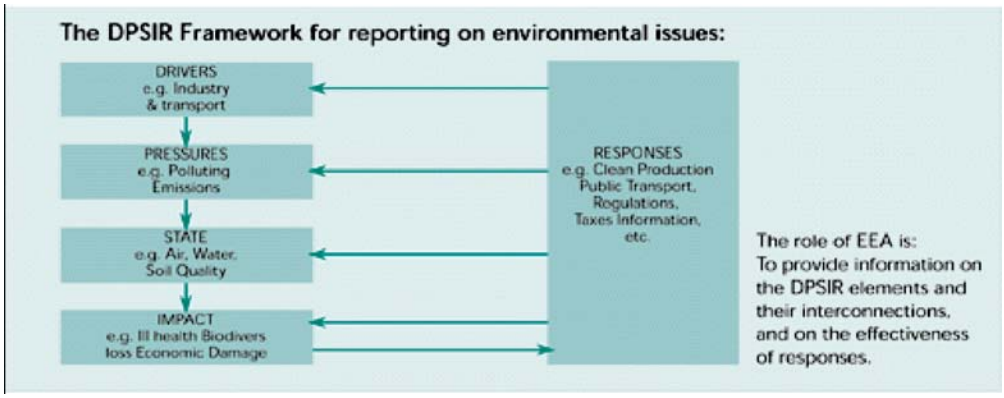
Table 7. Monetary capital model (discussed in section 2.5.1)

National Wealth	
Strengths	**Weaknesses**
Having a composite indicator of sustainability allows for direct comparison between countries and regions	The weaknesses which are inherent in the 'Net National Income' calculations, and the strong sustainability perspective led to the conclusion that the NNI indicator should be complemented with an additional set of indicators that would compensate for these inherent weaknesses
	Difficult to asses monetary value
	The sum of National Wealth over al nations does not necessairly result in a sustainable world. NNI has a very narrow, national focus although there is net income from abroad included in the national wealth calculations.

d. Model-based approaches: DPSIR model

Another model-based approach is called the DPSIR-approach, which is particularly useful for policy-makers because it 'offers a basis for analysing the inter-related factors that impact on the environment' (website of the European Environment Agency). The meaning of the abbreviation is: Driving force, Pressure, State, Impact and Response. The driving force e.g. can be (the production of) an enterprise, which causes a pressure on the environment (pollution), in which case the state of the ground deteriorates. This state has impact in that way that there is economic damage because the soil can not be used for the building of houses. As a response the soil should be cleaned.

As a good example of this, the EEA presents the following figure.



e. Some concluding remarks on indicator sets

The model-based as well as the policy-based approaches have preliminary a local/ national focus since the indicator sets are mainly being made for nations, groups of nations or government units at lower than national levels. Therefore extra efforts need to be made in order to include the global and international perspectives. In these ways, both approaches have much the same departure points.

The issue of the time frame appears to be one of the main differences between these two approaches. Inherent in the nature of the model-based approach is a long-term time perspective. The policy-based approach, on the other hand, could be more of a short-term focus since the policy cycles are often a matter of a few years. However, based on experience with Eurostat Working Group on Sustainable Development Indicators, the change of the strategy did not have a huge impact on indicators as the headline indicators for the most part remained the same and only slight changes in the supplementary indicators occurred.

2.6 Indicators used by other countries

Because of a huge amount of sustainable development indicators in other countries and international organisations it is very difficult to compare them. Therefore the main goal of this part of the literature study was to provide a clear overview of the existing indicators. In this section only a summary is presented. For a detailed description see appendix 1.

In table 8 we present the indicators that have been employed by 4 or more countries/organisations. It can be seen that the amount of indicators which adhere to this criteria is almost equal for each dimension. However, the amount of indicators for each theme differs tremendously. For example theme ‘Sustainable production and consumption’ and ‘management of natural resources’ have 10 and 8 indicators respectively and themes ‘good governance’ and ‘global partnership’ only one. The ‘transport’ theme is the only one with no indicators at all. Possible explanations are that some countries lack data on some of these indicators or the countries have focussed on specific themes.

Table 8. Summary of the most used indicators per theme

Theme: Socio-economic development			NA-consistent
	14	GDP per capita	x
	9	General government gross net debt	x
	7	Research & Development expenditure (and/or patents)	x
	6	Employment, by age group	x
	5	Investment share of GDP	x
	4	Inflation rate	
Theme: Sustainable production and consumption			
	10	Energy consumption by sectors	x
	9	Energy use and intensity	x
	9	Share of energy from renewable sources in total energy consumption	
	7	Domestic material consumption	#
	7	Municipal waste collected and its disposal	x
	6	Generation of (industrial) waste (by sectors) and its disposal	x
	5	Recycling of waste (paper and glass, construction)	x
	4	Consumption by chemical type	
	4	Generation and disposal of hazardous waste	x
	4	Generation and disposal of radioactive waste	
Theme: Transport			
Theme: Global partnership			
	11	Official Development Assistance	
Theme: Poverty and social exclusion			
	12	Unemployment rate by age, gender, education level	
	10	Risk of poverty	
	7	Female to male wage ratio (gender pay gap)	
	6	Inequality of income distribution	
	6	Reported crimes	
Theme: Public health			
	11	Life expectancy (at birth)	
	6	Mortality (below the age of 65 and/or due to selected illnesses)	
	6	Population growth rate (sometimes regional)	
	5	Old-age dependency ratio	
	4	Noise pollution (% of population exposed to traffic, railway and air traffic noise)	
	4	Working accidents (work related injuries)	
Theme: Education			
	5	The highest level of education attainment (by age group)	
	4	Access to the Internet	
Theme: Good governance			
	4	Voting activity (electoral participation)	
Theme: Climate change and air pollution			
	14	Emissions of greenhouse gases	x
	6	Air pollution (air quality)	x
	6	CO_2 emissions per capita and/or GDP	x
	6	Emission of ozon precursors	x
Theme: Management of natural resources			
	15	Biodiversity and number of protected species (birds, trees)	
	8	Agricultural area and organic farming	
	4	Area of protected land (to maintain biological density)	
	4	Development in areas as of nature, wood, farm land, housing and roads	
	4	Forest area and its utilisation	
	4	Proportion of surface water management (sewerage)	
	4	Quality of bathing and surface waters/ coastal eco-systems	
	4	Use of fertilisers and pesticides	
		x consistent with NA	
		# work in progress	
		empty cells - data exists but consistency is basically not applicable	

3. Possible strategies for Statistics Netherlands

In this section we will formulate the possible strategies which Statistics Netherlands can follow in order to measure (sustainable) welfare.

We advise that Statistics Netherlands will measure sustainable welfare by using a set of indicators at a macro economic level by means of indicators that focus on objective elements of welfare. This does not mean that we are not aware of the fact that the subjective aspects of life such as happiness of life satisfaction are of a great importance to people.

Regarding the critique with respect to GDP as a measure of welfare we agree with a lot of the arguments, however, we do not conclude that GDP cannot be used as one in a set of indicators of welfare. Consistent with the System of National Accounts 1993 (SNA93) GDP is a very good indicator for production activity and income but it was never meant to measure welfare. Therefore we are inclined to use GDP as one of the indicators in order to be able to determine welfare also because as SNA93 indicates in paragraph 1.69 "The consumption of goods and services, both individually and collectively, is one of the most important factors influencing the welfare of the community, *but is only one of several factors*."

In section 2.5.2 we have presented the one number approach methods. We can conclude that these methods have two major disadvantages and therefore cannot be employed by Statistics Netherlands. First of all, welfare is characterized by many different dimensions which cannot all be monetarized into a single number. In our opinion there is a danger present that a composite index will oversimplify a complex system and give potentially misleading signals. Second of all, the way of determining the weights for indicators such as the HDI is very subjective and should be made by politicians rather than statisticians.

Based on the above conclusions we would like to propose 3 possible strategies that can be employed by Statistics Netherlands. It should be noted that in all proposed strategies Statistics Netherlands will base the method, as far as possible, on the national accounts.

3.1 Hybrid capital approach

The hybrid capital approach constitutes the first of the possible options to develop a set of indicators for sustainable welfare. The capital approach is based on the concept of maintaining economic, environmental, human and social capital over time for the future generations. By definition, capital encompasses those inputs that are necessary in economic processes and that endure in order to ensure the continuity of the economic system. The World Bank employed genuine savings (GS) in its (monetary) capital approach as it provides a much broader indicator of sustainability by valuing changes in natural resources, environmental quality and human capital in addition to the traditional measure of changes in produced assets provided by net saving (World Bank, 2006). The GS, however, is an indicator of weak sustainability and it can be characterized in the capital approach as a flow variable (thus all

changes in the capital such as capital formation, depreciation and other). Negative GS rates imply that total wealth is in decline; policies leading to persistently negative GS are unsustainable.

The capital approach suggests the need to measure stocks of each form of capital and their evolution over time. In the case of natural capital, it also implies the need to measure the demand for the environmental services (e.g. CO_2 absorption) to determine whether demand exceeds the capacity of ecosystems. This suggests an expansion of the traditional production function to include all forms of natural capital (not only resources) and the negative outcomes of the economic production (e.g. waste) that can lead to worsening in the functioning of ecosystems. Measurement of these resources means estimating the quantity and/or quality in physical and where possible monetary terms. Also in the case of human and social capital most indicators will have other units because it is difficult or impossible to produce appropriate monetary values.

Inherent in the nature of capital is a long-term time perspective. This approach does not change over time to some extent and is theoretically robust. The main weakness of this approach is the risk that it will be less politically relevant and could not be used when implementing any policy with respect to sustainable development. Further, the indicator set resulting from a capital model approach needs to be evaluated to be sure it includes an international or global perspective what constitutes another weakness of the capital model approach when looking at it from the policy-based approach.

A useful way of implementation of this strategy is to compare the capital approach to the sustainable development indicators employed either by Eurostat or other countries. In other words, if possible, different forms of capital will be measured by SDI's. Thus the SD indicators will be divided into opening stock, flows (i.e. capital formation, depreciation and other changes) or closing stock. Only indicators that somehow match with the capital approach will be used.

The stocks of assets of the economic capital are measured according to SNA 93 conventions and those of natural capital according to the SEEA conventions. Regarding human and social capital the division in themes is based on the classification of the Working Group on Statistics for Sustainable Development (WGSSD).

3.2 Policy based approach

The next option refers to the so called policy based approach that has been already explained in section 2.2.3. The starting point here is the national strategy where the concept of sustainable welfare can be defined on basis of policy statements. Mostly, strategies with respect to the sustainable development are developed by the Ministry of Environment and therefore the most emphasis lies on environmental aspects of welfare. The advantage is that the indicators chosen for the various topics are relevant for policy directly. This approach however possesses a lot of disadvantages. One of these refers to the instability of this approach as political statements and policies are very likely to change relatively quickly what may lead to incomplete or

non-robust definition of sustainable development. This may also result in instability of the set of indicators what may cause difficulties when trying to track long-term trends for some phenomena since gathering of the data for new indicators can be costly and takes a lot of time. Of course it is not always like this because when looking for instance at Eurostat and participating countries when establishing the set of indicators based on the SDS, headline indicators did not change over time very drastically. Another disadvantage is that in the strategy some topics dominate other topics, so that the system is more or less incomplete.

If this approach is chosen, it is important to realize that the new government is still formulating its sustainable development strategy. Note also that if this option is chosen it will require a very large coordinating effort by Statistics Netherlands.

3.3 SDI sets in Dutch National Accounts setting

A third strategies would to base our indicator set on those of other countries or international organisation. In subsection 3.3.1 we propose a strategy which is based on international comparison of SDI's. Subsection 3.3.2 investigates the Eurostat set of indicators and the possibility of making it consistent with national accounts. In the last subsection the possibility of adaptation of the German and Swiss method is discussed.

3.3.1 *International comparison*

One alternative is to base our choice of indicators on the literature study that we have done with respect to SDI's of other countries and international organisations (for details see section 5.1 and 5.2). In table 8 in section 2.6 we have summarized the indicators per theme according to their frequency. We have chosen only indicators that were used by more than four countries/international organisations. Those indicators reflect what is internationally important with respect to sustainable development. Therefore they can be used for determining sustainable welfare in the Netherlands. It would not be wise to ignore the decision made by other countries when developing the conceptual frameworks for sustainable development. SDI sets usually come about after long deliberations. By comparing the outcome of these discussions this process can be made more efficient in the Netherlands as we have already defined the core of sustainable development in other countries and international organisations. For example, if almost all countries use greenhouse gasses as a headline indicator of climate change, it is unnecessary to have a discussion about that. Moreover the comparison between the Netherlands and other countries will be easier. If necessary the included indicators can be brought up for discussion with other parties. We have already checked whether the most frequently used indicators are either consistent with the National Accounts or can be potentially made consistent with NA. In the table in section 2.6 the results of this meta analysis are presented.

3.3.2 *Eurostat SDI's*

This alternative is very similar to the previous one. The only difference is that in this case only the sustainable development indicators used by Eurostat will be checked whether they are consistent with the National Accounts. Thus also here the indicators that were based on the policy approach will be checked whether they are consistent with the National Accounts.

3.3.3 *SDI sets of individual countries*

The last alternative is the adaptation of the system of another country. Where necessary it should be adapted to the Dutch situation.

Due to the quality of the indicator system and the easy consistency with the national accounts, we would favour the methods of Switzerland (advanced methodology, strong theoretical background) and Germany (National Accounting) respectively.

3.3.3.1 Germany

Germany has set up a number of indicators according to the 'three dimensions of sustainability' system indicated in the table of section 2.5.1. Most of the indicators chosen are consistent with the German system of national accounts what constitutes the main strength of the German method. It should be noted that the approach of Germany stresses environmental indicators.

Germany uses 21 headline indicators and their choice has been based on the national strategy for sustainable development.

3.3.3.2 Switzerland

Switzerland uses a theoretically impressive system called MONET. The project was carried out in close collaboration by three federal offices.

Switzerland has looked how other countries have developed a system of indicators in order to prevent that Switzerland reinvented the wheel. The starting point for sustainable development was the well-known Brundtland definition. Further, Switzerland did not need to take into account geographic or administrative units under the federal level, as is mostly necessary in bigger countries like Germany (Länder) and France (départements). Finally, the selection of indicators was discussed with relevant organisations and experts (13 working groups, involving over 80 specialists).

In the key document 17 headline indicators are centred around four main topics:

- Meeting needs (how well do we live?)
- Fairness (how well are resources distributed?)
- Preservation of resources (what are we leaving behind for our children?)
- Decoupling (how efficiently are we using our natural resources?)

The topics contain 4, 3, 6 and 4 indicators respectively to give an impression of (sustainable) welfare in Switzerland.

To analyse the phenomena in more detail Switzerland devised a system including 163 indicators (of which 28 are not feasible owing to lack of data). The 163 indicators have been classified in 26 themes. Themes, in general, are classified according to topics which are relevant for sustainable development. Sometimes a classification is designed on the basis of procedures, instead of topics, where the focus is on 'mechanisms and causal connections and attempts to record these in a model'.

Both of the approaches are of importance in an indicator system and therefore Switzerland has combined the two approaches by designing two classifications: one for themes and one for type of indicators. Each indicator belongs to a theme and to a category of type of indicator

Five types of indicators are distinguished:

L = Level: Extent to which the needs of the individual and society are met. The variable can be a stock or a flow variable.

C = Capital: Status and potential of (environmental, economic and social) to resources. The variable is a stock variable.

IO = Input/Output: Flows originating from 'capital' in order to meet the needs described under 'level', together with appreciation or depreciation of 'capital' (e.g. through investment or pollutant emissions). The variable is a flow variable.

S = Structural criteria: Assessment of 'in- and output' relative to (economic, social and environmental) efficiency and of disparities in the meeting of needs ('level') or in the provision of 'capital'. The variable is a stock variable.

R = Response: Social and political measures aimed at influencing in- and output. The variable is a flow variable.

The advantage of this strategy is that a rather quick survey of welfare in the Netherlands can be given on the basis of data which is mostly consistent with the national accounts. A disadvantage could be that the foreign systems of indicators are not applicable to the Netherlands.

3.3 Summary of the proposed strategies

Summarizing all the above proposed strategies it is also important to assess their external importance (significance). For example the WGSSD will probably propose the hybrid capital approach in its final report in 2008. The policy approach will be very interesting for VROM as they are preparing a new strategy and would like to cooperate with Statistics Netherlands. Eurostat would most likely want us to work on the Eurostat SDI set.

In table 9 we have assessed the strategies based on a number of criteria. We have tried to assess each strategy on the followings points: theoretical strength (is the strategy theoretically well underpinned?), policy relevance (is the strategy relevant for the policy in the country?), consistency with NA, dimension's coverage plus balance (are the three dimensions well covered and the indicators equally divided per dimension?) and implementation possibility (is the effort to implement the system time consuming and is it easy to adapt to the Dutch situation?).

Table 9. Assessment of the strategies

			Theoretical strength	Policy relevance	Consistency with NA	Dimension's balance + coverage	Implementation possibility
3.1 Hybrid capital approach			Capital approach has a solid theoretical basis. Inherent it has a long-term perspective.	Risk exists that capital approach is less policy relevant. In the case of the World Bank this approach connects to policy relevance. Another danger is that the global and international perspective remain underexposed.	Economic capital is entirely consistent with NA (SNA), natural capital with SEEA and thus as far as possible with NA. Human and social capital not always.	All three dimensions are well covered by the indicators and the balance between them is more or less equal.	Capital approach is a good steppingstone for a framework. The approach and its aspects have to be elaborated, especially for human and social capital. It can result in indicators that are not policy relevant.
3.2 Policy-based approach - national strategy (VROM)			Basics sustainable development theory (i.c. theory based on the three dimensions)	By definition	Tension between NA and policy based indicators can occur. E.g. policy based CO2 emissions differs from Kyoto figures.	Depends on strategy (risk that some topics dominate other topics).	No strategy at this moment in the Netherlands.
3.3 SDI sets in Dutch NA setting							
	3.3.1 International comparison		Pragmatic approach based on the frequency of indicators used internationally. Variable sustainable development theory as some countries have better theoretical underpinning than the other.	Policy relevant for the country itself. Relevance for the Netherlands probable possible.	A number of indicators is consistent with NA	All three dimensions are well covered by the indicators and the balance between them is more or less equal.	Transferability to the Dutch situation seems to be easy. This option gives an overall view of the sustainable development indicators as it is based on a comparison from a lot of countries.
	3.3.2 Eurostat SDI's		Basics sustainable development theory (i.c. theory based on the three dimensions)	See above.	A number of indicators is consistent with NA	All three dimensions are well covered by the indicators and the balance between them is more or less equal.	It can be easily adapted to Dutch situation.
	3.3.3 Country SDI's sets						
		3.3.3.1 Germany	Basics sustainable development theory (i.c. theory based on the three dimensions)	This strategy has a strong political relevance to Germany and its transferability to the Dutch situation is probable possible.	Most of the indicators are consistent with NA	All three dimensions are well covered by the indicators and the balance between them is more or less equal.	It can be easily adapted to Dutch situation.
		3.3.3.2 Switzerland	Very strong on two points: Strong theoretical basics and selection of indicators by means of a matrix combining capital elements and themes. Robustness of this system is very impressive as by means of discussions with a lot of experts they developed their set of indicators from the theory to the policy relevant approach.	This strategy has a strong political relevance to Switzerland and its transferability to the Dutch situation is probable possible.	A number of indicators are consistent with NA	All three dimensions are well covered by the indicators and the balance between them is more or less equal.	It can be quickly adapted to Dutch situation.

4. Conclusions

This paper provides an overview of the literature on welfare, wellbeing and sustainable development. Moreover the overview includes work done in other countries and international organisations.

The main aim of this paper was to propose/suggest a framework for sustainable welfare that is as general and comprehensive as possible and that can be used by science, general public as well as politicians and decision-makers. Therefore three strategies are suggested that could be employed by Statistics Netherlands. The reason for presenting more than one strategy is to bring them up for discussion with internal experts in order to choose the best option.

5. Appendices

5.1 Appendix 1. Description of indicators in other countries

In this section some preliminary results from the literature study that we have done so far with respect to the sustainable development indicators of other countries and international organisations will be presented. Due to the huge amount of indicators per country/organisation it is very difficult to compare them. Therefore the main goal of this part of our research was to provide a clear overview of the existing indicators in other countries

The following steps have been undertaken when selecting the countries and organisations:

- Only those countries have been selected that presented their indicators (implicit or explicit) using three dimensions: economic, social and environmental. I will come back to this issue later in the presentation.
- Only the sets of indicators coming from official government agencies such as statistical bureaus or ministries have been selected.
- Finally, only the indicators from countries that are more or less comparable to the Netherlands with respect to the economic development have been taken into analysis. Hereby it should be noted that we have heavily relied on the article from Julie Hass and Thorvald Moe "Challenges in establishing sustainable development indicators" written for the meeting in Oslo 2006. This article includes an updated list of SDI's, presented in the form of the table using the classification of the country.

1. Setting up the table

In our main table (appendix 2) the crossing has been made between the indicators and countries/ organisations. When filling in the table we have bundled similar indicators that describe the same phenomena under one name (we have grouped indicators which we deem to be similar). For example indicators such as GDP per capita, (regional) GDP in Purchasing Power Standards or GDP growth have been put together under one indicator "GDP per capita". Moreover the indicators that describe the same phenomena but were subdivided into categories (gender, age, educational level etc.) have been placed under one denominator where the break down (subdivision) is no longer visible. We could not avoid subjective assessment because we divided the indicators into themes and sub-themes only on basis of their names. Due to the time restriction, investigation of every single definition was impossible. The same subjective assessment applies for grouping similar indicators. In case of doubt the indicators were kept separate what explains a great number of indicators that were only mentioned once. In the third column the frequency of the indicators per sub-theme is given.

2. Limitations

Hereby some limitations will be pointed out. In the case of Switzerland and Finland we did not include all indicators because they were not included in the article of Hass and Moe. For example, in the case of Finland 50 SD indicators were omitted and Denmark 38. For Switzerland, only 17 headline indicators were included.

3. Classification of the dimensions

In the table below the classification of dimensions, themes and sub themes is given. Although it is a preliminary division of work in order to be able to group the SD indicators. There are three general dimensions upon which the sets of indicators are based, namely: economic, social and environmental. Due to a huge amount of indicators per dimension we have decided to divide the dimensions further into 10 themes en 32 sub themes. As a point of departure was here the classification made by Eurostat in the Monitoring Report (2005), however we have changed or renamed it partly and made our own classification because some categories were in our view not applicable for the overview. As already mentioned we could not avoid subjective assessment because the indicators were grouped into themes and sub-themes only on basis of their names.

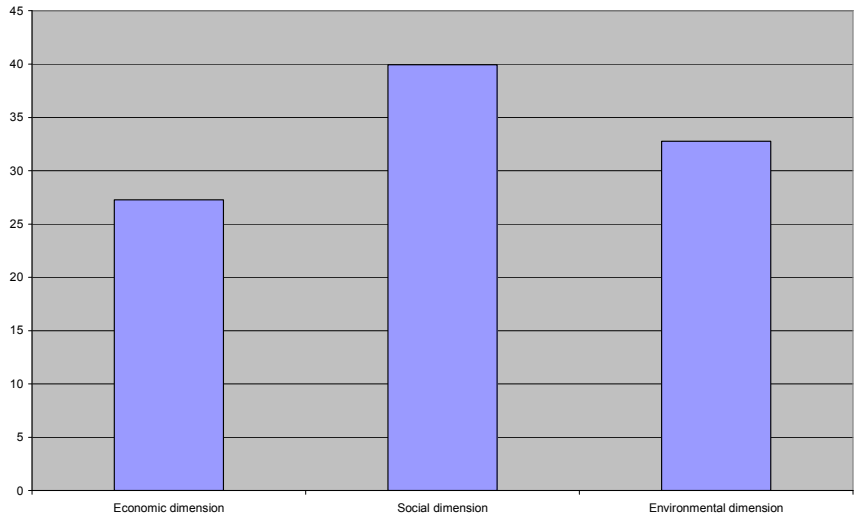
Classification of dimensions and (sub-)themes

Sustainable welfare	Economic dimension	Socio-economic development	Economic development
			Innovation, R&D
			Competitiveness
			Employment
		Sustainable production and consumption	Generation and treatment of waste
			Consumption and production of energy
			Material consumption and production
			Eco-efficiency
		Transport	Economic impact
			Social impact
			Environmental impact
		Global partnership	Globalization of trade
			Financing for SD
			Environmental aspects
	Social dimension	Poverty and social exclusion	Living conditions
			Labour market
			Inequality
			Security
			Poverty
			Other aspect
		Public health	Health protection and lifestyles
			Food safety and quality
			Illness and addiction
			Demographic changes
		Education	Education
		Good governance	Policy coherence and effectiveness
			Openness and participation
	Environmental dimension	Climate change and air pollution	Climate change and air pollution
		Management of natural resources	Biodiversity
			Fresh water
			Land use
			Other aspects

4. Distribution of the indicators per dimension

In the chart below (chart 1) the percentage of indicators per dimension is given. The real value of this chart is rather limited as the subjective assessment with respect to the division of the indicators could not be avoided. The chart is meant only for a rough picture of the scope of the dimensions.

Chart 1. Distribution of the indicators

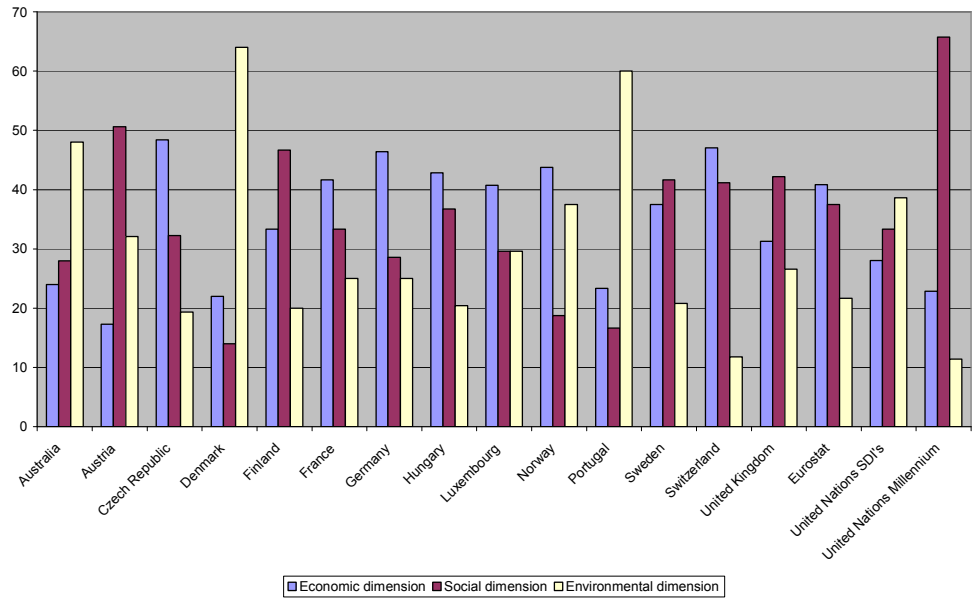


As it can be roughly seen in the above chart 40% of the indicators belongs to social dimension, 33% to the environmental dimension. The rest, 27%, belongs to the economic dimension.

5. Percentage of indicators per dimension by country

In chart 2 the percentage of indicators per dimension for each country is given. What is very striking is that in the case of Denmark and Portugal the emphasis lays on the environmental dimension. On the other hand, when looking at Switzerland and United Nation's Millennium Indicators, the environmental dimension constitutes a smaller part when compared to the other dimensions in those countries.

Chart 2. Percentage distribution of indicators per dimension, by country



Summarizing, our preliminary results show the indicators which most countries adopt. The distribution of the SDI's is almost equal per dimension, however the number of indicators is unequal per theme**.** Despite the above mentioned limitations, the acquired knowledge from this study will be helpful when developing the conceptual framework of sustainable welfare in the Netherlands. It would not be wise to ignore the decision made by other countries when developing the conceptual frameworks. Moreover the comparison between the Netherlands and other countries will be easier.

SDI sets come through long discussion, by comparing the outcome of these discussions in other countries we hope to make the process more efficient in the Netherlands

5.2 Appendix 2. Indicators other countries and international organisations

		Sub-thema's	Australia	Austria	Czech Republic	Denmark	Finland	France	Germany	Hungary	Luxem-bourg	Norway	Portugal	Sweden	Switzerland	United Kingdom	Eurostat SD-	United Nations Indicators of SD	United Nations Millenium
Theme: Socio-economic development																			
Indicators:																			
14	GDP per capita	Economic development	X	X	X	X	X	X	X	X	X		X	X		X	X	X	
9	General government gross net debt				X		X		X	X	X			X	X		X	X	
5	Investment share of GDP									X					X	X	X	X	
4	Inflation rate									X	X			X			X		
3	Genuine savings		X			X											X		
3	National income per capita		X									X					X		
2	Capital formation								X		X								
2	Foreign direct investment						X			X									
2	Net current account				X					X									
2	Value added by main sectors of economy									X	X								
1	Balance of trade in goods and services																	X	
1	Business climate													X					
1	Development in agricultural income										X								
1	Disposable income per capita		X																
1	Real wages													X					
1	Assistance funds as a percentage of GNI					X													
1	Sustainable public finances: need for tightening of public finances as share of GDP											X							
1	Total consumption expenditure as percentage of GDP																X		
7	Research & Development expenditure (and/or patents)	Innovation & R&D		X	X		X		X					X			X	X	
3	Innovation and technology (turnover)													X	X		X		
3	Labour productivity	Competitiveness			X											X	X		
2	Competiveness in relation to other OECD countries assessed in terms of relative costs of work unit (real effective exchange rate)						X										X		
2	Multi-factor productivity		X													X			
1	Unit labour cost growth, for total and industry																X		
6	Employment, by age group	Employment			X	X			X					X		X	X		
1	Hours worked per person													X					
1	Share of women in wage employment in the non-agricultural sector																		X
1	Employment rate for immigrants and number of non-Finnish speaking schoolchildren						X												
Theme: Sustainable production and consumption																			
Indicators:																			
7	Municipal waste collected and its disposal	Generation and treatment of waste						X		X	X			X		X	X	X	
6	Generation of (industrial) waste (by sectors) and its disposal			X		X				X			X	X			X		
4	Generation and disposal of hazardous waste									X				X			X	X	
4	Generation and disposal of radioactive waste									X				X			X	X	
5	Recycling of waste (paper and glass, construction)				X	X				X			X					X	
1	Waste recovery												X						
1	Recycling og raw material in construction business					X													
10	Energy consumption by sectors	Consumption and production of energy		X	X		X	X		X	X		X			X	X	X	
9	Share of energy from renewable sources in total energy consumption		X		X		X	X	X				X			X	X	X	
9	Energy use and intensity				X					X	X	X		X		X	X	X	X
3	Energy production									X				X		X			
3	Fossil or biofuel consumption													X	X		X		
2	Electricity generation															X	X		
1	Environmental profile of the Energy sector					X													
1	Proportion of population using solid fuels																		X
1	Energy tax revenu																X		
1	Productivity of energy								X										
1	Energy prices													X					
1	Comparison of energy indicators									X									
1	Electricity consumption																X		
1	External costs of energy use																X		
7	Domestic material consumption	Material consumption and production		X	X					X			X		X	X	X		
4	Consumption by chemical type			X						X				X			X		
1	Intensity of material use																	X	
1	Productivity of raw materials								X										
1	Meat consumption																X		
1	Sustainable consumption: petroleum adjusted savings											X							
1	Household consumption of hazardous substances											X							
2	Number of ecolabelled products	Eco-efficiency				X											X		
1	Eco-label awards, by country and by product group																X		
1	Ethical financing																X		
1	Green cars													X					
1	Investments in sustainable consumption and production													X					
1	Number of EMAS and ISO 14001 registered enterprises					X													
1	Number of enterprises, size and specialisation (harmonic and nonharmonic					X													
1	Share of area under EU agri-environmental support in total utilised agricultural area																X		
Theme: Transport																			
Indicators:																			
3	Pattern of passenger transport	Economic impact								X					X		X		
3	Freight transport by mode									X					X		X		
3	Volume of transport (passenger and freight)			X												X	X		
3	Public and private transport						X							X		X			
2	Intensity of goods (fright) transport				X				X										
2	Passenger transport intensity				X				X										
2	Modal Split										X						X		
2	Road transport															X	X		
1	Share of railway traffic and inland water transport								X										
1	Freight transport prices by mode																X		
1	Transport of goods													X					
1	Investment in transport infrastructure by mode																X		
3	Access of population to mobility	Social impact		X												X	X		
1	Accessibility															X			
1	Getting to school															X			
1	Distance travelled per capita by mode of transport																	X	
3	Emissions of air pollutants (from transport activities)	Environment al impact		X												X	X		
2	External costs of transportation			X													X		
2	Environmental protection expenditures (industrial and public sector)				X					X									
1	Fragmentation of habitats due to transport																X		
Theme: Global partnership																			
Indicators:																			
2	EU imports from developing countries	Globalisation of trade							X								X		
2	Sale of selected fair trade labelled products			X													X		
1	Proportion of total developed country imports from developing countries																		X
1	Average tariffs imposed by developed countries on agriculture products and textiles and clothing from developing countries																		X
1	Agriculture support estimate for OECD countries as a percentage of their GDP																		X
1	Total number of countries that have reached their HIPC																		X
1	Implementation of ratified global agreements																	X	
1	Trade with poor countries													X					
11	Official Development Assistance	Financing for SD		X				X	X		X	X		X	X	X	X	X	X
3	Amount of spendings on central themes of Public Development Cooperation			X			X										X		
2	Global poverty reduction, (trade with African countries)											X		X					
1	Total international development cooperation				X														
2	CO2 emissions in industralised and developing countries	Environmen tal agreem												X			X		
2	Contribution of the Clean Development Mechanism (CDM) to reducing greenhouse gas emissions in developing countries			X													X		
1	Environmental exports													X					

		Sub-theme's	Australia	Austria	Czech Republic	Denmark	Finland	France	Germany	Hungary	Luxem-bourg	Norway	Portugal	Sweden	Switzerland	United Kingdom	Eurostat SD-	United Nations Indicators of SD	United Nations Millenium
Theme: Poverty and social exclusion																			
Indicators:																			
3	Household composition	Living conditions								X				X			X		
3	(Improvement of) housing conditions									X						X	X		
2	Average living area (house) per persoon										X							X	
2	Satisfaction with housing situation			X												X			
2	Well-being in the living environment			X												X			
2	Main telephone lines per 1000 inhabitants																	X	X
1	Close social and functional mixing (differences between nationalities)			X															
1	Homelessness															X			
1	Dwelling density															X			
1	Housing costs relative to household income			X															
12	Unemployment rate by age, gender, education level	Labour market		X	X		X			X	X	X	X	X	X		X	X	X
2	Working climate index			X										X					
2	People living in jobless households, by age group															X	X		
1	Total unemployment rate by nationality and disabilities			X															
1	Economically inactive															X			
1	Job satisfaction			X															
7	Female to male wage ratio (gender pay gap)	Inequality	X	X					X	X				X			X	X	
6	Inequality of income distribution			X						X				X	X		X	X	
2	Equivalised household income			X											X				
2	Humans with less than USD 1 in income, in the world					X													X
1	Environmental equality															X			
1	Proportion of household expenditures on services						X												
6	Reported crimes	Security		X					X	X				X				X	
3	Physical safety (sense of security)			X											X	X			
1	Average duration of court proceedings				X														
1	School security													X					
10	Risk of poverty	Poverty		X	X			X			X		X	X	X		X	X	X
1	Corruption perceptions index				X														
1	Households living in fuel poverty															X			
1	Childhood poverty															X			
1	Pensioner poverty															X			
1	Level of social benefit per capita									X									
1	Poverty mobility (i.e. probability to enter or exit poverty)																X		
2	Volunteer work (unpaid work)	Other aspects		X												X			
1	Distance of certain services from the homes of 15-74-year olds						X												
1	Housekeeping, childcare, and other forms of care			X															
1	Economic dependency ratio by province						X												
1	On-line availability of the administration							X											
1	Museum sites awarded a quality label			X															
1	Availability of public cultural services				X														
1	Public expenditure on cultural activities			X															
1	Cultural activities over the past 12 months			X															
1	Compatibility of work and family life			X															
1	Leisure activities			X															
1	Activities by associations and groups			X															
1	Loneliness													X					
1	Trust in media													X					
Theme: Public health																			
Indicators:																			
4	Working accidents (work related injuries)	Health protection and lifestyles				X	X				X						X		
4	Noise pollution (% of population exposed to traffic, railway and air traffic noise)			X									X	X			X		
3	Health care expenditure relative to GDP			X						X							X		
3	Traffic accidents													X			X		
3	Child welfare (young adults)									X				X		X			
3	Population connected to sanitation system									X							X		X
2	Self-perceived health status (by level of income)			X										X					
2	Satisfaction with health			X					X										
2	Health behaviour			X										X					
2	Immunization against childhood diseases									X								X	
1	Prevelence of underweight children under five years of age																		X
1	Proportion of population below min level of dietary energy consumption																		X
1	Contraceptive prevalence rate																	X	
1	Full-time day-care facilities (e.g.créche)								X										
1	Health inequality															X			
1	Parental leave													X					
1	Percent of population with access to primary health care																	X	
1	Population of urban formal and informal settlements																	X	
1	Resistance to antibiotics (Streptococcus pneumoniae pathogens)																X		
1	Work with high level of job strain/stress																X		
3	Nutrition status of population	Food safety and quality								X					X			X	
3	Food contaminated with residues of pesticides + dioxin, PCB, heavy metals and mercury			X		X											X		
1	Consumption of cancer developing products in the Danish industry					X													
1	Sales figures for organic food			X															
6	Mortality (below the age of 65 and/or due to selected illnesses)	Illness and addiction	X		X				X	X						X			X
3	Obesity													X		X	X		
3	Percentage of smokers													X		X	X		
2	Death according to cause (suicide or food-borne diseses)										X						X		
2	Occurence of bronchial asthma and asthma, allergenic cold, and allergic eczema					X								X					
1	Prevelance and death rates associated with malaria and tuberculosis																		X
1	Proportion of population in malaria-risk areas using effective malaria prevention and treatment measures																		X
1	Proportion of tuberculosis cases detected																		X
1	Alcohol													X					
1	Body mass index			X															
1	Cancer incidence rate, by gender and by type																X		
1	Diet															X			
1	Disability		X																
1	Proportion of 1 year-old children immunised against measles																		X
1	Proportion of births attended by skilled health personnel																		X
1	HIV prevelence among pregnant women aged 15-24 years																		X
1	Condom use rate of the contraceptive prevalance rate																		X
1	Number of sickness related to nutrition products					X													
1	Per capita alcohol consumption and deaths attributable to alcohol						X												
1	Salmonellosis incidence rate in human beings																X		
1	Sickness absenteeism													X					
11	Life expectancy (at birth)	Demographic changes	X		X	X	X	X		X		X		X		X	X	X	
6	Population growth rate (sometimes regional)						X			X	X		X			X		X	
5	Old-age dependency ratio						X	X			X			X			X		
2	Employment of older people				X												X		
2	Projected changes in age-related public expenditure on pensions and education			X													X		
2	Fertility													X			X		
2	Healthy life years at birth and/or at age 65			X													X		
2	Net migration rate									X							X		
1	Projected theoretical replacement ratio																X		
1	Pensioner provision															X			
1	Average exit age from the labour market																X		
1	People with low employment potential						X												
Theme: Education																			
Indicators:																			
5	The highest level of education attainment (by age group)	Education	X	X	X				X	X		X							
4	Access to the Internet				X									X				X	X
3	Early school-leavers			X					X								X		
3	Life-long learning			X										X			X		
2	Low level of education attained									X							X		
2	Level of tertiary education		X								X								
2	Literacy rate of 15-24 years old																	X	X
2	Proportion of pupils starting grade 1 who reach grade 5																	X	X
2	Ratios of girls to boys in primary, secondary and tertiary education																	X	X
1	Foreign school-leavers not gaining the first secondary school-leaving certificate								X										
1	Public expenditure on education																X		
1	Ratio of literate women to men, 15-24 years-old																		X
1	Sustainable development education															X			
1	Basic requirements of the educational system													X					
1	Human capital													X					
1	Immediate placement of 9th grade students in further studies						X												
1	Net enrolment ratio in primary education																		X
1	Percentage difference in the year 12 completion rate between bottom up and top socio-economic decile in 1999		X																
1	Ratio of school attendance of orphans to school attendance of non-orphans aged 10-14 years																		X
1	Teenage reading skills														X				
Theme: Good governance																			
Indicators:																			
2	Implementation of Community Law	Policy coherence and effectiveness											X				X		
1	Framework conditions for SD			X															
1	National sustainable developement strategy																	X	
1	Administrative costs imposed by legislation																X		
1	Autoritarianism index (freedom)			X															
1	Number of infringement cases brought in front of the Court of Justice, by policy area																X		
1	Proportion of environmentally harmful subsidies																X		
1	Responses to EC Internet public consultations																X		
1	Service satisfaction of citizens examined by municipal class						X												
1	Share of major proposals in the Commission's Legal and Work Programme for which an impact assessment has been undertaken																X		
4	Voting activity (electoral participation)	Openness and participation		X			X							X			X		
3	Environmental taxes			X										X			X		
2	Citizen's confidence in institutions			X													X		
1	Number of LA21 processes			X															
1	E-government on-line availability																X		
1	E-government usage by individuals																X		
1	Active community participation															X			
1	Participation of 14-year olds in social organizational work						X												
1	Proportion of seats held by women in national parliament																		X
1	Civil society				X														
1	Social justice															X			

		Sub-thema's	Australia	Austria	Czech Republic	Denmark	Finland	France	Germany	Hungary	Luxem-bourg	Norway	Portugal	Sweden	Switzerland	United Kingdom	Eurostat SD-	United Nations Indicators of SD	United Nations Millenium
Theme: Climate change and air pollution																			
Indicators:																			
14	Emissions of greenhouse gases	Climate change and air pollution	X	X		X	X	X	X	X	X	X	X	X		X	X	X	
6	Emission of ozon precursors		X			X					X		X			X	X		
6	Air pollution (air quality)								X				X	X		X	X	X	
6	CO_2 emissions per capita and/or GDP				X	X								X		X	X		X
3	Emissions of acidifying substances											X	X				X		
3	Air pollutants in urban areas		X							X								X	
3	Average (surface) air temperatures					X							X	X					
3	Consumption of ozone depleting substances									X				X				X	
2	Thickness of Ozon layer			X		X													
2	Decoupling illustrated by Environmental impact in relation to GDP for 4 factors: GH, runoffs of nutrients into the sea, emission of acidifying substances, emission to air					X	X												
2	Numbers of chemicals which have been classified					X											X		
2	Use of energy and natural resources in relation to economic growth						X										X		
1	Exceedance of public information threshold values for tropospheric ozone												X						
1	Projected GHG emissions up to 2020			X															
1	Exceedances of the limit value for PM10 (particulate matter)			X															
1	Exceedances of the ozone targetvalue for the protection of human health			X															
1	Exceedances of the ozone target for the protection of vegetation			X															
1	Exceedances of the NO2 limit value for the protection of vegetation			X															
1	Emission of SO2, Nox, VOC and NH3					X													
1	Atmospheric concentration of CO2					X													
1	Gamma dose rate			X															
1	Local envrionment quality															X			
1	CO_2 removed by sinks																X		
1	The effect of climatical changes measured by the start and size of the pollen season					X													
1	Ecological impacts of air pollution															X			
1	UV (and ionising) radiation intensity			X															
Theme: Management of natural resources																			
Indicators:																			
15	Biodiversity and number of protected species (birds, trees)	Biodiversity	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	
3	Numbers of fishing stock with spawning within safe biological limits, and numbers of fisheries administered within safe biological limits					X										X	X		
1	Known reserves in the North Sea as of year production					X													
1	The capacity of the fishery fleet					X													
1	Activities to promote biodiversity			X															
1	Annual catch by major species																	X	
1	Area of selected key eco-systems																	X	
1	Areas of natural habitats					X													
1	Catchment condition index		X																
2	Cod population/ TAC actually set and catches of Northeast Arctic cod (Norway)											X		X					
1	Index of alien species of plants				X														
1	PCB in cod lever, cod captured in Danish territory					X													
1	Percent of total population living in coastal areas																	X	
1	Status of species and biology included in NATURA 2000					X													
1	Sufficiency of Member States proposals for protected sites under the EU Habitats directive																X		
4	Proportion of surface water management (sewerage)	Fresh water	X	X									X					X	
4	Quality of bathing and surface waters/ coastal eco-systems									X		X	X			X			
2	Management of fish		X														X		
2	Intensity of water use									X						X			
3	Attainment of goals and quality of water for lakes / fresh water eco-systems			X		X						X							
2	Biochemical oxygen demand (BOD) of largest rivers									X								X	
2	Groundwater quantity and quality			X													X		
2	Population served by public water supply												X					X	
1	Fish catches outside safe biological limits							X											
1	Proportion of population with sustainable access to improved water source, urban and rural																		X
1	Resource flows for 3 factors (energy consumption, drinking water consumption, waste) in relation to GDP					X													
1	Earth pollution clean up, made in connection with building of houses or supply of drinking water					X													
1	Algae concentration in coastal waters																	X	
1	Bodies of runnuing water: ecological and chemical condition			X															
1	Beaches with low quality water, bathing not advised					X													
1	Substantially modified or artificial bodies of water: ecological potential and chemical condition			X															
1	Concentration of faecal coliform in freshwater																	X	
1	Degree of pollution in inland waters										X								
1	Domestic water consumption															X			
1	Water stress															X			
1	Drinking water quality												X						
1	Population with access to safe drinking water																	X	
1	Pesticides in water used for drinking					X													
1	Emissions of organic matter as biochemical oxygen demand to rivers																X		
1	Estuarine condition index		X																
1	Index of toxic chemical risk to aquatic environment																X		
1	Nutrient load in (Baltic) sea						X												
1	Runoffs of CO and phosphate to the sea					X													
1	Rainfall												X						
1	Water extraction												X						
8	Agricultural area and organic farming	Land use			X				X	X	X		X			X	X	X	
4	Development in areas as of nature, wood, farm land, housing and roads					X			X						X		X		
4	Area of protected land (to maintain biological density)										X		X	X					X
4	Forest area and its utilisation		X							X								X	X
3	Land use										X					X	X		
3	Nitrogen surplus								X					X			X		
3	Proportion of ecological agriculture					X			X					X					
2	Bio-geographical sub-regions with greater than 10 percent of the sub-region's area in protected areas at 2000		X															X	
2	Changes in use of land (forest, grassland)			X														X	
1	Land recycling															X			
1	Development Oof Finland's use of natural resources 1970-2025						X												
1	Development of specific areas for ÖPUL measures			X															
1	Development in the area/lenght and quality of characteristic landscape features			X															
1	Percentage of sealed land			X															
1	Use of soil												X						
1	Forest trees demaged by defoliation										X								
1	Governmental aquisition of land areas for nature purposes					X													
1	Land recycling															X			
1	Net value of rural land		X																
1	Area of urban formal and informal settlements																	X	
1	Bio-geographic sub-regions with greater than 30 percent of original vegetative cover (as a percentage of 334 sub regions) at 2000		X																
1	Critical loads																X		
1	Erosion of coast												X						
1	Fragmentation of land			X															
1	Land affected by desertification																	X	
1	Percentage of forest trees damaged by defoliation																X		
1	Percentage of total land area at risk of soil contamination																X		
1	Percentage of total land area at risk of soil erosion																X		
1	Surface area of managed grassland			X															
1	Treatment frequency of pesticides on conventional cultivated areas					X													
4	Use of fertilisers and pesticides	Other aspects			X					X							X	X	
3	Environmental management systems												X	X			X		
2	Disasters (floods, mudflows, avalanches)			X												X			
2	Green public procurement													X			X		
1	Economic and human loss due to natural disasters																	X	
1	The agricultural influence illustrated by energy consumption, pesticide treatment and units of animals)					X													
1	Sales of pesticides, classified as specially dangerous					X													
1	Environmental protection expenditure													X					
1	Maintaining and protecting heritage monuments													X					
1	Consumption of basic nutrients				X														
1	Danish consumption of inland resources					X													
1	Employees of environmental companies													X					
1	Level of animal medicine leftovers in food					X													
1	Resource dependency			X															
1	Runoff and removal of agricultural nutritions					X													
1	Forest fires												X						
1	Accumulation of harmful substances in the topsoil or exceedance of the recomended values			X															
1	Percentage of farmland with anti-erosion measures			X															

Sources:
Australia: Hass et al., 2006
Austria: Monitoring SD, 2006
Czech Republic: Hass et al., 2006
Denmark: Hass et al., 2006, still 38 indicators (sectors)
Finland: Hass et al, 2006, still 50 additional indicators
France: 12 high level SDI's, situation as of December 31st 2006
Germany: Indicator report, Federal Statistical Office, 2006
Hungary: Hass et al, 2006
Luxembourg: Hass et al., 2006
Norway: Hass et al., 2006
Portugal: Hass et al., 2006
Sweden: Hass et al., 2006
Switzerland: Sustainable Development: A Brief Guide, 2005
UK: Hass et al., 2006
Eurostat: Monitoring report, 2006
UN (SDI and Millennium Indicators): Hass et al., 2006

5.3 Appendix 3. Additional literature

Hereby we present an additional list of articles that were useful for our study, but have not explicitly mentioned in the main text of this paper. Therefore they are not mentioned in the references.

SNBI/ ISEW/ GPI

1. England, R.W., (1998), 'Should we pursue measurement of the natural capital stock?' Ecological Economics 27, pp. 257-266
2. Lawn, P., (2003), 'A theoretical foundation to support the Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (GPI), and other related indexes', Ecological Economics 44, pp. 105-118
3. Lawn, P., (2005), 'An assessment of the valuation methods used to calculate the index of sustainable economic welfare (ISEW), genuine progress indicator (GPI), and sustainable net benefit index (SNBI)', Environment, Development and Sustainability 7, pp. 185–208
4. Lawn, P. and Sanders, R.D., (1999), 'Has Australia surpassed its optimal macroeconomic scale? Finding out with the aid of 'benefit' and 'cost' accounts and a sustainable net benefit index', Ecological Economics 28, pp. 213-229

ISEW/GPI

5. Costanza, R., Erickson, J., Fligger, K., Adams, A., Adams, Ch., Altschuler, B., Balter, S., Fisher, B., Hike, J., Kelly, J., Kerr, T., McCauley, M., Montone, K., Rauch, M., Schmiedeskamp, K., Saxton, D., Sparacino, L., Tusinski, W. and Williams, L., (2004), 'Estimates of the Genuine Progress Indicator (GPI) for Vermont, Chittenden County and Burlington, from 1950 to 2000', Ecological Economics 51, pp. 139-155
6. Hamilton, C., (1999), 'The Genuine Progress Indicator methodological developments and results from Australia', Ecological Economics, 30, pp. 13-28
7. Neumayer, E., (2000), 'On the methodology of ISEW, GPI and related measures: some constructive suggestions and some doubt on the 'threshold' hypothesis', Ecological Economics 34, pp.347–361
8. Talberth, J. and Bohara, A.K., (2006), 'Economic openness and green GDP', Ecological Economics, 58, pp. 743-758
9. Torras M., (2006), 'Ecological inequality in assessing well-being: Some applications', Policy Science, 398, pp. 205-224

ISEW

10. Castan˜eda, Beatriz E., (1999), 'An index of sustainable economic welfare (ISEW) for Chile', Ecological Economics 28, pp. 231-244
11. Clarke, M. and Islam, S.M.N., (2005), 'Diminishing and negative welfare returns of economic growth: an index of sustainable economic welfare (ISEW) for Thailand', Ecological Economics 54, pp. 81-93
12. England, R.W., (1998), 'Measurement of social well-being: alternatives to gross domestic products', Ecological Economics, 25, pp. 89-103
13. Max-Neef, M., (1995), 'Economic growth and quality of life" a threshold hypothesis', Ecological Economics 15, pp. 115-118
14. Pulselli, F.M., Ciampalini, F., Tiezzi, E. and Zappia, C.(2006), 'The index of sustainable economic welfare (ISEW) for a local authority: A case study in Italy', Ecological Economics, 60, pp. 271-281

HDI

15. Dowrick, S., Dunlop, Y. and Quiggin, J., (2003), 'Social indicators and comparison of living standards', Journal of Development Economics, 70, pp. 501-529
16. Gomanee, K., Morrissey, O., Mosley, P., and Verschoor, A., (2005), 'Aid, Government Expenditure, and Aggregate Welfare', World Development Vol. 33, No. 3, pp. 355–370
17. Neumayer, E., (2001), 'The human development index and sustainability - a constructive proposal ', Ecological Economics 39, pp. 101–114

Welfare

18. Lintott, J., (1998)'Beyond the economics of more: the place of consumption in ecological economics', Ecological Economics, 25, pp. 239–248

Genuine Savings

19. Arrow, K.J., Dasgupta, P., and Karl-Göran Mäler, (2003), 'The genuine savings criterion and the value of population', Economic Theory, 21, pp.217-225
20. Atkinson, G. and Hamilton, K., (2003), 'Savings, Growth and the Resource Curse Hypothesis', World Development Vol. 31, No. 11, pp. 1793–1807
21. Auty, R.M., (2006), 'Natural resources, capital accumulation and the resource curse', Ecological Economics, Article in press
22. del Mar Rubio, M., (2004), 'The capital gains from trade are not enough: evidence from the environmental accounts of Venezuela and Mexico', Journal of Environmental Economics and Management, 48, pp.1175-1191

23. Neumayer, E., (2000), ‘Resource Accounting in Measures of Unsustainability. Challenging the World Bank’s Conclusions’, Environmental and Resource Economics 15, pp. 257–278
24. Neumayer, E., (2004), ‘Does the ‘‘Resource Curse’’ hold for Growth in Genuine Income as Well?’, World Development Vol. 32, No. 10, pp. 1627–1640
25. Pezzey, J.C.V., Hanley, N., Turner, K. and Tinch, D., (2006), ‘Comparing augmented sustainability measures for Scotland: Is there a mismatch?’, Ecological Economics, 57, pp.60-74
26. Pillarisetti, J.M., (2005), ‘The World Bank’s genuine savings measure and sustainability’, Ecological Economics, 55, pp. 599-609

Capability Approach

27. Robeyns, I., (2003), ‘The Capability Approach: An Interdisciplinary Introduction’, University of Amsterdam, revised version 9

Critique with respect to GDP

28. Smulders, S., (1995), ‘Entropy, Environment, and Endogenous Economic Growth’, International Tax and Public Finance, 2, pp.319-340

Sustainability (Weak/ Strong Sustainability)

29. Ayres, R., (2006), ‘On the practical limits to substitution’, Ecological Economics, available at www.sciencedirect.com
30. Bartelmus, P., (2003), ‘Dematerialization and capital maintenance: two sides of the sustainability coin’, Ecological Economics 46, pp. 61-81
31. Daly, H., (1992), ‘Allocation, distribution, and scale: towards an economics that is efficient, just, and sustainable’, Ecological Economics, 6, pp.185-193
32. Dodds, S., (1997), ‘Towards a “science of sustainability”: Improving the way ecological economics understands human well-being’, Ecological Economics, 23, pp. 95-111
33. Ekins, P. and Simon, S., (2003), ‘An illustrative application of the CRITINC framework to the UK’, Ecological Economics, 44, 255--275
34. Ekins, P., Simon, S., Deutsch, L., Folke, C. and De Groot, R., (2003), ‘A framework for the practical application of the concepts of critical natural capital and strong sustainability’, Ecological Economics, 44, pp.165-/185

35. Hanley, N., Moffatt, I., Faichney, R. and Wilson, M., (1999), 'Measuring sustainability: A time series of alternative indicators for Scotland', Ecological Economics, 28, pp. 55–73
36. Hediger, W., (2000), 'Sustainable development and social welfare', Ecological Economics, 32, pp. 481–492
37. Rennings, K. and Wiggering, H., (1997), 'Steps towards indicators of sustainable development: Linking economic and ecological concepts', Ecological Economics, 20, pp. 25-36
38. Ronchi, E., Federico, A. and Musmeci, F., (2002), 'A system oriented integrated indicator for sustainable development in Italy', Ecological Indicators, 2, pp. 197-210

References

1. Austria, (2006), 'Monitoring Sustainable Development in Austria', Federal Ministry of Agriculture, Forestry, Environment and Water Management
2. Bleys, B., (2006), 'The Index of Sustainable Economic Welfare. Summary of the case Study for Belgium', Vrije Universiteit Brussel, Belgium
3. Brundtland Commission Report, (1987), 'Our Common Future', World Commission on Environment & Development
4. Clark, David A., (2005), 'The Capability Approach: Its Development, Critiques and Recent Advances', Economic & Social Research Council, Global Poverty Research Group, Document GPRG-WPS-032
5. Cobb, J. (1998), 'Growth without Progress?', Religion Online, 3 March 1998. http://www.religion-online.org/showarticle.asp?title=198
6. Daly, H.E., and Cobb, J., (1989), 'For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future', Beacon Press, Boston, MA.
7. De Haan, M., Leunis, W.P. and Verbruggen, M., (2002), 'European structural indicators, a way forward', Statistics Netherlands
8. Desai, M, (1995), 'Greening of the HDI?' in: McGillivray, A. (Ed.), Accounting for change. The New Economics Foundation, London, , pp. 21-36
9. Easterlin, R.A., (2001), 'Income and happiness: Towards a unified theory', The Economic Journal, 111, 465-484
10. Eurostat, (1996), 'European system of accounts, ESA 1995'.
11. Eurostat, (2005), 'Measuring progress towards a more sustainable Europe', Sustainable development indicators for the European Union
12. Ferrer-i-Carbonell, A., (2005), 'Income and well-being: an empirical analysis of the comparison income effect', Journal of Public Economics 89(5-6): 997-1019
13. Figge, Frank and Hahn, Tobias, (2004), 'Sustainable Value Added – measuring corporate contributions to sustainability beyond eco-efficiency', Elsevier, Ecological Economics 48 (2004) 173-187
14. Frey, B.S, and Stutzer, A., (2002), 'What can economists learn from happiness research?', Journal of Economic Literature, 40: 402-435
15. Germany, (2006), 'Sustainable Development in Germany', Indicator Report 2006, Federal Statistical Office of Germany
16. Hartwick, J., (1977), 'Intergenerational equity and the investing of rents from exhaustible resources', American Economic Review, 67, pp. 972-974

17. Hass, Julie and Moe, Thorvald, (2006), 'Challenges in establishing sustainable development indicators', Working Paper 8, Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development, Second meeting, Oslo, 15-16 November 2006

18. Hueting, R., (1974), 'Nieuwe Schaarste en Economische Groei', Elsevier, Amsterdam.

19. Hueting, R, (2007), Wikipedia ('SNI' and 'Roefie Hueting') with many key references

20. Kazemier, B., Keuning, S., and van de Ven, P., (1999), 'Measuring Well-being with an Integrated System of Economic and Social Accounts: an Application of the SESAME Approach to the Netherlands'

21. Keuning, S., (1997), 'SESAME: an integrated economic and social accounting system'. In: International Statistical Review (1997), 65, 1, 111-121

22. Lawn, Philip A. and Sanders, Richard D., (1999), 'Has Australia surpassed its optimal macroeconomic scale? Finding out with the aid of 'benefit' and 'cost' accounts and a sustainable net benefit index', Elsevier, Ecological Economics 28 (1999) 213-229

23. Lawn, Philip, A., (2003), 'A theoretical foundation to support the Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (PI) and other related indexes', Ecological Economics, 44, pp. 105-118

24. Lintott, J., (1996), 'Environmental accounting: useful to whom and for what?', Ecological Economics, 16, 179-190

25. Marijs, A.J. en Hulleman, W., (1998), 'Macro-economische ontwikkelingen en bedrijfsomgeving', Wolters-Noordhoff, Groningen

26. Matthews, Erica, (2006), 'Measuring well-being and societal progress: a brief history and the latest news', Statistics Directorate, OECD

27. 'Millieurekeningen 2005', Statistics Netherlands, 2006

28. Neumayer, Eric, (1999), 'The ISEW- Not an Index of Sustainable Economic Welfare', Social Indicators Research, 48, pp.77-101

29. Neumayer, Eric, (2001), 'The human development index and sustainability – a constructive proposal', Ecological Economics, 39, pp. 101-114

30. Nordhaus, W.D. and Tobin, J., (1973), 'Is growth obsolete?': In: M. Moss (Editor), The Measurement of Economic and Social Performance, NBER, New York

31. Nussbaum, M.C., (2000), 'Women and Human Development: the Capabilities Approach', Cambridge: Clarendon Press

32. SEEA (2003), 'Integrated Environmental and Economic Accounting 2003', Final draft circulated for information prior to official editing

33. Sen, A, (2007), Wikipedia ('Sen's Capability Approach') with many key references

34. Statistics Netherlands, (2006), 'National accounts of the Netherlands 2005'

35. Stockhammer, E., Hochreiter, H., Obermayr, B. and Steiner, K., (1997), 'The Index of Sustainable Economic Welfare (ISEW) as an alternative to GDP in measuring economic welfare. The Results of the Austrian (revised) ISEW calculation 1955-1992', Ecological Economics, 21, pp. 19-34

36. Switzerland, (2004), 'Monitoring Sustainable Development', MONET, Final Report – Methods and Results, Swiss Federal Statistical Office

37. Switzerland, (2005), 'Sustainable Development: A brief Guide. 17 key indicators to measure progress', Swiss Federal Statistical Office

38. Timmerman, J.G., and van de Ven, P., (1994), 'A social accounting matrix for the Netherlands: concepts and results', Statistics Netherlands

39. Tversky, A., and Simonson, I., (2000), 'Context-dependent preferences', in: D. Kahneman and A. Tversky (eds), 'Choices, Values and Frames', Cambridge University Press, Cambridge, pp. 518-527

40. United Nations, (1977). 'The feasibility of Welfare-Oriented Measures to Supplement the National Accounts and Balances: A Technical Report'. Studies in Methods, Series F, Number 22, United Nations, New York.

41. United Nations, (1993), 'System of National Accounts'

42. Van den Bergh, J.C.J.M., (2006), 'Abolishing GDP. The Largest Information Failure in the World', Publication of the Free University, Amsterdam

43. Van de Kerk, Geurt, (2006), 'Nederland duurzaam? De Index voor een Duurzame Samenleving', IDS 2006, Uitgeverij De Vijver, Afferden

44. Van Praag, B., and Ferrer-i-Carbonell, A., (2004), 'Happiness Quantified: A Satisfaction Calculus Approach', Oxford University Press, Oxford

45. Van de Steeg, A., Hoekstra, R., Kazemier, B., and Schenau, S., (2006), 'Measuring Well-being Using the Dutch National Accounts', Short paper for: measuring well-being and social progress: a workshop. 19-21 June 2006 Milan (Italy)

46. Van de Ven, P., Kazemier, B., and Keuning, S., (2000), 'Measuring Well-being with an Integrated System of Economic and Social Accounts, 2000 Meeting of the Sienna Group', Statistics Netherlands

47. Veenhoven, R. and Timmermans, D., (1998), 'Welvaart en geluk', gepubliceerd in Economisch Statistische Berichten (ESB), 28-08-1998, pp. 628-631

48. World Bank (2006), 'Where is the Wealth of Nations?', The World Bank, Washington D.C.