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Measuring Sustainable Development and Societal Progress: Overview and Conceptual Approach

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Remarks:
The basis of this conceptual work on measuring sustainable development started at Statistics Netherlands in the summer of 2007. Previous versions of this paper have been presented at numerous workshops, conferences and meetings. We are grateful to all the input that we have received, but it is nearly impossible to mention all the people that have provided feedback. We would however like to thank, in particular, Peter van de Ven, Tineke de Jonge, Brugt Kazemier, the members of the Task Force for Measuring Sustainable Development (TFSD) and our colleagues at the CPB, PBL and SCP that we worked with on the Dutch Sustainability Monitor.

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MEASURING SUSTAINABLE DEVELOPMENT AND SOCIETAL PROGRESS: OVERVIEW AND CONCEPTUAL APPROACH

Summary: This paper presents the methodological framework that Statistics Netherlands uses to measure the multidimensional concepts of sustainable development and societal progress. It shows how the Dutch approach fits in a large stream of international work done in this field and discusses a wide range of academic literature as well as existing international datasets on sustainable development.

Keywords: sustainable development, sustainability, capital, welfare, wellbeing, quality of life, "beyond GDP", economic capital, financial capital, natural capital, human capital, social capital, progress of societies. Sustainable Development Indicators (SDI)

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1. Introduction

There is a wide-spread feeling that society needs a better statistical 'compass'. It is argued that in defining our societal goals we should go "beyond GDP". It is widely acknowledged that GDP is a dominant measure which plays an important role in society and government policy. However, it should be noted that GDP does not cover all issues relating to human wellbeing and sustainable development properly (van den Bergh, 2009).

This debate is not new. The inadequacies of GDP, as well as alternative ways of measuring the progress of societies, have been debated for many decades (Lintott, 1996; Mebratu, 1998; van den Bergh, 2009). The intensity of these debates has varied over time but it seems fair to say that the last decade has seen a resurgence of interest. This has been fuelled by environmental problems such as climate change and biodiversity loss, but can also be related to the further diffusion of the concept of sustainable development in society. Other major events, such as the financial crisis, have also led to self-reflection about the sustainability of the economic system and the ways in which we measure economic and societal progress.

The renewed interest is epitomised by the various international initiatives that were started by large international institutes (United Nations, OECD and European Commission) in the 2000s. Particularly after the publication of the seminal Stiglitz-Sen-Fitoussi (SSF) report (Stiglitz et al, 2009)[1], the call for such a new statistical framework is stronger than ever. This SSF-Commission was instigated by President Sarkozy of France and included Nobel laureates and other influential scientists. The publication of this report has led to a new wave of initiatives on measuring sustainable development. Statistics Netherlands is actively involved in, and in some cases leads, a number of these international initiatives (see box 1 for details).

These international projects build on work that Statistics Netherlands has carried out within the Netherlands, among others its work on the development of a Sustainability Monitor (Monitor Duurzaam Nederland). The first version was published in February 2009 (CBS et al., 2009), the second was released September 2011 (CBS et al., 2011). The project was carried out in conjunction with the Dutch

[1] Statistics Netherlands' response to the recommendations of the Stiglitz report are provided in Hoekstra et al. (2010).

government's policy institutes: The Netherlands Bureau for Economic Policy Analysis (CPB), the Social and Cultural Planning Office of the Netherlands (SCP), and the Netherlands Environmental Assessment Agency (PBL).

This paper provides the methodological underpinning of Statistics Netherlands international and national work on measuring sustainable development and the progress of societies. The goals of this paper are twofold:

- To provide an overview of the historical and current state of affairs in the "Beyond GDP" debate.
- To provide the conceptual basis for measuring sustainable development and to derive a long and short list of indicators from them.

The conceptual framework that is presented links the concepts of wellbeing, welfare and sustainable development. The theory is based on four core areas of the literature:

- *Brundtland report*. Like nearly all work on sustainable development the Brundtland definition is used (WCED 1987).
- *"Broad concept of welfare"* (in Dutch: het brede welvaartsbegrip). The measurement theory is also based on the broad concept of wellbeing that has a long and impressive history in the Netherlands (Hennipman, 1945; Hennipman, 1977; Heertje, 2007). This strand of literature clearly goes "Beyond GDP" as it focuses on *all* aspects which are relevant for people's wellbeing, and not only those aspects which are included in the System of National Accounts.
- *Stiglitz-Sen-Fitoussi Commission*. This report has greatly influenced the Dutch work on sustainable development. First of all, like the SSF Report, the work of Statistics Netherlands is strongly based on economic theory, For example, the inter-generational aspects of sustainable development are measured by indicators which are derived from economic growth- and capital theory. Besides, just as was suggested in the Stiglitz Report, in the measurement of sustainable development, Statistics Netherlands clearly separates the current and future aspects of sustainable development and places them in different dashboards.
- *Broad range of social science literature.* Despite the strong focus on economic theory, the selection of SD themes as well as the actual choice of indicators is also inspired by a wide range of social science literature. This is especially relevant for the parts of the SDI set which deal with current human wellbeing and social capital, topics which are extensively discussed in social and political sciences, in happiness literature and in articles on the so-called social production function..

Reading guide

This paper not only does contain a large amount of information that has to be conveyed in a structured and understandable manner, but most importantly the potential audience of this paper is also very diverse. Readers may include environmental economists, policy makers, sustainability consultants, lobbyists, politicians, students or members the public with a specific interest in sustainable development. Each reader will have an interest in, and knowledge of, different aspects in this debate. It is impossible to satisfy each member of this audience fully, and we therefore do not aim to do so. Nevertheless, we have made a deliberate effort to facilitate the various types of readers in a number of ways:

- Since this paper has to be understandable for those who know little about this topic, various chapters only provide "broadbrush" discussions. To facilitate people who want to know more about a certain topic, we make sure that each section provides the appropriate references for further reading.
- The paper has been set up in a modular way. It is therefore relatively easy to skip certain sections without losing the train of thought in the latter parts of the paper.

Section two and three provide overviews of the history of measuring sustainable development and the current state of affairs, respectively. Section four discusses a conceptual model that is consistent to the Brundtland definition of sustainable development, economic theory and incorporates insights from a broad range of social science literature. Section five identifies the themes that should be distinguished in an SDI set, while in section six a long and a short list of SDI's are distinguished. Finally, sections seven and eight provide conclusions and thoughts on future directions.

The sections two-four can be read as stand-alone sections. Sections four to six should be read together if one wants to understand the link between the conceptual model and the actual choice of indicators.

Readers that are interested in the Sustainability Monitor for the Netherlands (CBS, 2011) are referred to Appendix 1.

2. A brief historical overview

Literature on societal developments and its sustainability has a long history. Many authors have argued that its roots go back many centuries and that elements of it can be found in a wide variety of sources such as religion, philosophy, economics, forestry and environmentalism (Mebratu, 1998). A complete overview of this literature is, however, beyond the scope of this paper. The literature has therefore been narrowed down to publications that look specifically at *measurement* issues.

2.1 The System of National Accounts

Given the importance of GDP and economic theory in the subsequent sections, it is useful to reflect upon the history of economic measurement briefly. Measuring the income of nations goes back many centuries[2], but the modern variety of national accounts, which leads to indicators such as GDP, finds its origin in the period of the great depression of the 1930s. In the decades that followed the initial concepts were debated and elaborated by prominent economists.[3]

The United Nations played an important role in harmonizing economic measurement by the publication of *A System of National Accounts and Supporting Tables, Studies in Methods of 1953*. The handbook, which subsequently evolved into the *System of National Accounts*, was updated several times to reflect the most recent scientific insights and statistical possibilities (1953, 1960, 1964. 1968, 1993)[4]. The latest instalment is the 2008 edition.[5]

The SNA is regarded as one of the most important and influential statistical innovations in history. The brief historical overview shows that the success of SNA

[2] The World Bank (2011) sees the Doomesday book, which was commissioned by William the Conqueror in 1058/59 as one of the first efforts to measure "wealth". At the end of the 17th century national income estimates were created in England (Petty, 1665; King 1696) and France (Boisguillebert and Vuban). Later Francois Quesnais produced the *Tableau Economic* (1766). For a history of this early period see Studenski, 1958; Bos, 2003.

[3] Kuznets, Leontief and Stone received Nobel prizes for work related to the National Accounts and many other Laureates such as Hicks, Meade and Frisch did work related to the SNA system (see Studenski, 1958; Bos, 2003).

[4] All versions of the SNA are available at http://unstats.un.org/unsd/nationalaccount/hsna.asp

[5] The SNA presents the flows of output, income and expenditure of an economy within one coherent framework. Nowadays, the SNA provides important information to policy makers on, for example, economic growth, employment, investments, productivity and balance of payments.

and its indicators (e.g. GDP), did not happen overnight. It is often overlooked that it took several decades to harmonize and agree upon the concepts and methods. It also took time for countries to implement the SNA in their national statistical systems.[6]

Just as old as the SNA is the criticism of the SNA. Since its inception there has been debate over what the system actually measures and what it does not capture (for an overview of arguments see van den Bergh (2009).[7] A lot of the criticism stems from dominance of GDP in society and its incorrect use as a proxy to measure human wellbeing (and its sustainability). Although the SNA explicitly states that GDP is a measure of the level of economic activity and not of social welfare[8], it remains a dominant indicator in many scientific and political debates.

Not only is GDP not a measure of (current) social welfare, but it also does not take on board the impact on future welfare, i.e. its sustainability. The modern idea of sustainable development is very much driven by the notion that mankind should not create economic and social prosperity at the expense of future generations. For example, countries that have large reserves of natural resources can maintain high level of GDP by extracting them as fast as they can. This clearly has a positive effect on the economic activity for the current generation, but at the detriment of those to come.

GDP therefore fails to account for the reduction in resources and the critical limits of our planet. This notion of planetary boundaries was raised in the seminal work of Thomas Malthus, an eighteenth century demographer and political economist, who argued that the population could not continue to grow because there was limit to the amount of food that could be produced by our planet.[9] As the next section will show

[6] Nowadays, estimates of GDP are produced by nearly every country in the world and for enormous time periods (Madisson, 2001). Most developed countries provide quarterly estimates.

[7] Also an alternative system, the Material Product Accounts, was used up to 1993 in the Soviet Union and many Eastern European countries. In this system the measurement concerned only goods producing sector and transport but excluded (government) services.

[8] The SNA is very clear about the use of GDP: "Neither gross nor net domestic product is a measure of welfare" (United Nations, 1993, section 2.178).

[9] In An Essay on the Principle of Population (1798) Malthus concluded that a population could never grow indefinitely because the area of agricultural land is fixed and will therefore only be able to produce a fixed amount of food. Starvation would therefore be eminent. As Malthus put it: "The power of population is indefinitely greater than the power in the earth to produce subsistence for man." Of course, its is now known that agricultural production can

many publications in the twentieth century are inspired by this Malthusian notion of boundaries or 'limits to growth'.

2.2 Pre-Brundtland: Economic composite indicators

In response to growing environmental problems and increasing awareness of the global limits, an environmental movement started to emerge in the 1950s and 1960s. Influential books such as Rachel Carson's *Silent Spring* (1962), Garret Hardin's *Tragedy of the Commons* (1968) and Paul Ehrlich's *Population Bomb* (1968) set the tone for an increased scientific and popular interest for environmental issues. In this setting, the criticism of macro-economic measures such as GDP, which does not incorporate environmental or other external effects, also swelled.

This criticism has led to many initiatives that have tried to "correct" GDP and other macroeconomic aggregates, by adding and subtracting components. In this way the aggregates would provide better indicators for (social) welfare or sustainable welfare. These are known as *economic composite indicators*, of which a variety emerged since the 1960s. Initially, many of these indicators focussed on the aspects such as the monetisation of household work and the correction for defensive expenditures. The "correction" for environment aspects came somewhat later[10]. A very influential indicator was that of *Green (or Sustainable) National Income* which was developed by Roefie Hueting (1974) at Statistics Netherlands. These economic composites benefited from the environmental mindset of the early 1970s. It is period of influential publications (e.g. *Limits to growth* report: Meadows et al., 1972) and influential conferences (e.g. the United Nations Conference on the Human Environment in Stockholm in 1972).

The economic composite indicators are largely the product of scientific enterprise. Of course, some indicators got a lot of attention in statistical and policy circles, but to this day none has managed to become the "official" alternative to GDP.

2.3 Post-Brundtland: Composite indicators and SDI sets

The international breakthrough of the concept of sustainable development is

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be raised through growth of agricultural productivity and is therefore not fixed. However, the idea that there are bounds to the planets carrying capacity endures to this day.

[10] Examples from the 1970s are the Measure of Economic Wellbeing (MEW) (Nordhaus and Tobin, 1973) and Sustainable National income (SNI) (Hueting, 1974).

invariably attributed to the seminal Brundtland report which was published in 1987.[11] The report was named after the chairperson of the United Nation's World Commission on Environment and Development (WCED, 1987). The Brundtland report was also very important in broadening the scope of sustainable development beyond environmental concerns to include social aspects, both on a national and international scale.

While the Brundtland report is usually credited with the conceptualization of sustainable development, the United Nations "World Summit on Sustainable development" at Rio in (1992) and Johannesburg (2002) (Rio+10) provided a large boost to the measurement of sustainable development.

The post-Brundtland and post-Rio period has seen a strong impulse of measurement initiatives. There are a number of competing methods that have emerged: composite indicators and indicator sets.

Composite indicators

The Post-Brundtland economic composite indicators of the 1990s built on the earlier indicators in which macro-economic aggregates are "corrected". These corrections are based on notions derived from macroeconomic research and often involve monetisation of non-market activities. Examples include ISEW, GPI, IEWB, GS and the SNBI.[12]

In the same period of time a second type of composite indicators emerged, which were not based on conventional, often neoclassical, economic theory. The methodologies for these vary. In the case of the Human Development Index (HDI), which is based on the capabilities approach of Sen, an unweighted average of economy, education and health indicators are taken. Another very influential indicator is the Ecological Footprint (EF). It measures the requirements of consumption packages of national economies using a land area metric (Rees and

[11] Note that the term "sustainable development" was coined, at least in an international document, by the International Union for the Conservation of Natural Resources (IUCN) which published the World Conservation Strategy (WCS) in 1980. The report did not however contain a specific definition of SD.

[12] Index of Sustainable Economic Welfare (ISEW) (Cobb, 1989), Genuine Progress indicator (GPI) (Cobb et al, 1995), Index of Economic Wellbeing (IEWB), Genuine Savings in 1999 (Pearce and Atkinson, 1993) and Sustainable Net Benefit Indicator (Lawn and Sanders, 1999).

Wackernagel, 1994)[13]. Other examples of non-economic composites include HPI, SSI or LPI.[14]

A third type of overall indicator that has gained prominence in the 1990s and 2000s, is the direct measurement of subjective wellbeing. These indicators are created by surveying individuals and asking them about their happiness or life satisfaction. Although these measurements have taken place since the 1970s (Easterlin, 1974), the field has gained in stature enormously in the last decade (Layard, 2011; and Anielksi, 2007).

Sustainable Development Indicators (SDI) sets

One of the effects of the Rio conference was the installation of the Commission on Sustainable Development (CSD) in the early 1990s. Up to that point, composite indicators were the norm and in that respect the work of the CSD led to a major shift because it recommended the use of indicator sets. In this philosophy, the concept of sustainable development is considered to be a multidimensional phenomenon which should be measured by an array of indicators, rather than one single indicator.

The CSD consulted many stakeholders to decide upon a recommended set of SDI indicators in 1995. The list of indicators has been revised twice since the first edition (see United Nations (2007) for the last edition). The concept of indicator sets took some time to catch on. Only a few countries, including the United Kingdom, started to produce SDI sets in the mid-1990s. The use of indicators sets started to increase in the wake of the "Rio+10"-Conference in Johannesburg in 2002, in which countries were stimulated to produce national sustainable development strategies (NSDS). A large share of the developed countries started to produced indicator sets as part of their NSDS. Also, larger institutes such as Eurostat launched their SDI set (2005). Furthermore, institutes such as the OECD and the World Bank were stimulated to start up large scale projects on measuring progress and sustainable development. In box 1 a number of these initiatives will be discussed.

[13] See http://www.footprintnetwork.org for extra information. See van den Bergh and Verbruggen (1999) for a critical appraisal.

[14] The Happy Planet Index (HPI) (see happyplanetindex.org); Sustainable Society Index (SSI) (Van der Kerk, 2008; http://www.ssfindex.com/ssi/) and the Living Planet Index (LPI) (WWF, 2010).

3. Current state of play

3.1 An age of harmonization?

This short survey of statistical initiatives shows that the post-Brundtland period has been a highly fruitful period in the implementation of new statistical initiatives on measuring sustainable development and societal progress. Nearly every country, institute and scientist that has looked at the issue has produced their own, unique "new and improved" approach.

Of course, the lack of harmonization is partly due to the fact that countries differ in which aspects are relevant to their "progress". Cultural, religious and philosophical differences might inspire a different view of what a society should strive for. Besides, differences in academic approaches, differences of stakeholder participation and data availability, to name a few, may explain in the differences in these various approaches.

The lack of harmonisation of SDI sets is particularly striking because this method started with the SDI set recommended by the CSD. The aim of this set was to provide a template which countries could use as a starting point for their SDI development. Nevertheless, nearly all countries that adopted SDI sets have created lists of indicators that are very different to the CSD set. An underlying problem is the lack of a common theoretical underpinning for these sets.

Such a level of divergence in methodology is worrying, since only a common harmonized methodology will be able to compete with a successful indicator such as GDP. Therefore the idea to share experiences and harmonizing methodologies has become increasingly important in the 2000s. Quite a number of international institutes have taken it upon themselves to create working groups, task forces and global projects in order to facilitate the exchange of knowledge and harmonization of concepts and methodologies. It remains to be seen how successful these efforts will be in realising an international standard which can be implemented across the board. If the SNA process is any indication, it would be a matter of decades instead of years.

Box 1 discusses some of the international initiatives to harmonize the measurement of sustainable development and societal progress. However, before this is done, it is important to understand the main points of contention which people disagree about.

Box 1. International initiatives

In this box a number of international initiatives are summarized which are important in the international discussion and harmonisation of measurement of sustainable development. They are (in chronological order)[15]:

- 1991 - Commission for Sustainable Development (UN)
- 2001 – European Strategy for Sustainable Development (EC)
- 2007 – GDP and Beyond (EC)
- 2007 - Task Force for Measuring Sustainable Development (UNECE/OECD/Eurostat)
- 2007 – Progress of Society (OECD)
- 2009 - Stiglitz Commission
- 2010 – Sponsorship group on measuring progress, well-being and sustainable development (EC)
- 2012 – E-frame (EC)

Statistics Netherlands is heavily in the TFSD, the Sponsorship group and the E-frame projects. Below we provide a short description of each of these international initiatives.

Commission on Sustainable Development

The United Nations Commission on Sustainable Development (CSD) was established by the UN General Assembly in December 1992 to ensure effective follow-up of United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit or Rio Conference.
In 1995 a first set of sustainable development indicators was published and was subsequently revised twice (United Nations, 2007). The indicator set gives guidance to countries when choosing its sustainable development indicators.

EU sustainable development strategy

The EU Sustainable Development Strategy (EU SDS) was one of the first European initiatives addressing progress, well-being and sustainable development. The European Council adopted the strategy in 2001 which, following a review in 2005, was renewed in 2006. The EU SDS sets out a coherent approach to how the EU will

[15] Note that we have exclude some influential initiatives such as the Europe 2020 strategy and the Millennium Development Goals (MDG) because in this section focuses on initiatives to share experiences and harmonize measurement practices.

more effectively live up to its long-standing commitment to meet the challenges of sustainable development.

The EU SDS requires regular reporting on progress, drawing on a biennial monitoring report drafted by Eurostat, which is based on an indicator framework. The sustainable development indicator framework was developed by Eurostat with the assistance of an ESS Taskforce on Sustainable Development Indicators.

European Commission "GDP and beyond"

In November 2007, the European Commission (together with the European Parliament, the Club of Rome, the WWF and the OECD) organised the Beyond GDP conference (ref). The conference revealed strong demand from policymakers, economic, social and environmental experts and civil society for indicators that complement GDP and aim to provide more comprehensive information to support policy decisions.

Following up on this request the "GDP and beyond"-Communication aims at developing more inclusive indicator sets that provide a more reliable knowledge base for better public debate and policy-making It points to the need to improve, adjust and complement GDP with indicators that concisely incorporate social and environmental achievements (for example, improved social cohesion, accessibility and affordability of basic goods and services, education, public health and air quality) and losses (e.g., increasing poverty, more crime, depleting natural resources).

Task Force on measuring sustainable development (TFSD)

In 2007, the working group on sustainable development statistics (WGSSD), was established by the United Nations Economic Commission for Europe, OECD and Eurostat. The WGSSD report was published in 2009 proposed a broad conceptual framework that focussed on the future-oriented (capital) approach.

Subsequently the Task Force on Measuring Sustainable Development (TFSD) was installed as a follow-up of the WGSSD. The Task Force has been mandated to deal with a variety of issues which were not fully worked out by the WGSSD. The most important of these is the measurement of the human and social capital and the definition of an indicator sets that will appeal to both the future and integrated views. The group produce its final report in the summer of 2012.

Statistics Netherlands leads this Task Force and are responsible for the final report (Rutger Hoekstra and Jan-Pieter Smits).

Measuring the progress of societies

In June 2007 in Istanbul, the OECD, in collaboration with other international organizations, ran the second World Forum on "Measuring and Fostering the Progress of Societies". The conference led to the Istanbul Declaration, which calls for action to identify what progress means in the 21st century and to stimulate international debate, based on solid statistical data and indicators, on both global issues of societal progress and comparisons of such progress. The declaration urges "statistical offices, public and private organisations, and academic experts to work alongside representatives of their communities to produce high-quality, facts-based information that can be used by all of society to form a shared view of societal well-being and its evolution over time".

The OECD has since developed a framework to measure the progress of societies (for the purpose of providing a head start to future initiatives wanting to measure the progress of a society.

Stiglitz Commission

In February 2008, French President Nicolas Sarkozy launched the Commission on the Measurement of Economic Performance and Social Progress (CMEPSP), chaired by Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi. It is popularly referred to as the Stiglitz Commission. The report identified the limits of GDP as an indicator of economic performance and social progress, to consider what additional information might be required for the production of more relevant indicators of social progress, and to assess the feasibility of alternative measurement tools (Stiglitz et al, 2009).

Sponsorship group on measuring progress, well-being and sustainable development

The Sponsorship Group is an initiative of European (Eurostat) and the French Statistical Office (INSEE) to forward the work of the Stiglitz Commission and the "Beyond GDP" communication of the Euorpaan Commission. The Directors General of the National Statistical Institutes (DGINS) agreed to work together to take this work forward. In September of 2011, recommendations will be provided on changes to the European Statistical System (ESS) to improve the measurement of societal progress.

E-frame

The E-frame consortium, which is funded by the Eorepean Comission, is headed by the Italian Statistical Bureau (ISTAT) and Statistics Netherlands. This consortium consists of a great number of European Statistical institutes, universities and the OECD. This groups aims at pushing the agenda on "Beyond GDP" measurement. A great number of workshops will be organised where statisticians and members of the academic community will meet in order to give an impulse to the work on sustainable development in general, and on more detailed topics such as social capital, footprints and the measurement of wellbeing in particular.

3.2 Main Debates

The main sources of contention are the following:

- Ecological versus broad societal perspective
- Integrated versus future-oriented view
- Composite indicators versus SDI sets
- Monetisation
- Policy versus conceptual approach

Ecological versus broad societal perspective

Most of the literature on sustainable development focuses on ecological phenomena. The publication of the Brundtland Report did help to broaden the concept to include economic, social and institutional phenomena and many of the SDI sets reflect this broad conceptualisation. Of course, this broad view on sustainable development has its advantages as human wellbeing is caused by more than only ecological determinants. However, environmentalists fear that by including socio-economic factors, this will distract from the ecological problems that constitutes some of the largest threats to sustainability.

Statistics Netherlands has opted for the broad societal approach for theoretical reasons. The concept of human wellbeing and capital are broader than ecological phenomena and it is therefore not tenable regard sustainable development as a purely ecological matter. Furthermore, it helps to study environmental issues in a broader societal context. In order to be able to analyse the fundamental trade offs underlying the sustainability problem, the ecological, economic and institutional aspects of sustainable development need to be considered simultaneously. .

Given the ecological challenges that the world faces, Statistics Netherlands does feel that the environmental dimension merits its own publication which goes deeper into the sources and drivers of ecological problems than our publications on sustainable development. Various publications, including the most recent "Green Growth" publication, are available (CBS, 2011).

Integrated versus future-oriented view

The Brundtland report stressed the fundamental trade-offs between human wellbeing "here and now", "elsewhere" and "later". Distributional justice is of seminal importance in this approach. Due attention is paid to intra-generational fairness of distribution (distribution between different social groups within one country or distribution on a world-wild scale between the high-income and less developed countries), as well as to the inter-generational aspects (relating to the question as to whether there are enough assets for future generations so that they can pursue their welfare goals).

The difference between the integrated and future oriented approach is quite simple: while the integrated approach, following the Brundtland conception, focuses on all three dimensions ("here and now", "later" and "elsewhere"), the future oriented approach argues that the "later" dimension should be included in the concept of sustainable development.

The future-oriented approach focuses squarely on the inter-generational issues. It limits itself to evaluate to what extent enough assets or capital is left for future generations. This future-oriented view on sustainable development is often operationalised in terms of the "capital approach" (Pearce and Atkinson, 1993; Atkinson et al., 2007), as leaving intact our stocks on relevant types of capital is an important prerequisite for future generations to be able to pursue their welfare goals; to meet their needs. It is important to realise that there is a monetary variety of the capital approach (which leads to a composite indicator) and the hybrid capital approach (which uses a set of indicators).[16]

[16] The best known variety of capital approach is the *monetary capital* approach in which all assets types are monetised. Expressing the capital stocks in terms of their monetary value opens up the possibility to arrive at one total estimate of capital (economic wealth). From a theoretical point of view it is however also possible to measure capital stocks in different (volume) units. This is known as the *hybrid capital approach* (see Kulig et al, 2009). The

Statistics Netherlands follows the integrated approach. Not only is this the most common approach in the existing SDI sets, it also is more easy to link the integrated approach to broader debates such as "GDP and Beyond" and "Progress of Societies". Besides, policy makers clearly indicate that they want to base decisions on the use of resources on the basis of the needs of both the present and future generations.

Composite indicator versus SDI sets

In the discussion of the history of measuring sustainable development, one of the core differences is the choice between composite indicators and SDI sets. Broadly speaking one could say that indicator sets are preferred by nearly all international institutes and national statistical offices. The World Bank is an exception to the rule: it adopts composite indicators (genuine savings/comprehensive wealth) for its research on sustainable development. Composite indicators are more popular in academia and also in environmentalist groups that find it easier to communicate their message using a single indicator. Policy makers can be found on both sides of the debate, with some preferring indicator sets an overall indicator to guide their policies.

Monetisation

To arrive at a single indicator economic, composite indicators use a common metric: money. This means that elements that are not usually measured in monetary terms, have to be monetized. Examples include the valuation of leisure time or household production.

The monetisation of capital stocks also leads to contention. Monetised estimates of physical capital, parts of natural capital, R&D and even human capital are quite common nowadays. Monetary estimates on social capital do not exist although the World Bank does estimate the total capital stock (and "intangible capital"as a residual).

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advantage is that it is not necessary to adopt the assumptions that are required for monetization. However, aggregation is not possible. The monetary capital approach is used frequently in the academic community and the World Bank, while most SDI set use capital measures in non-monetary units.

It should be noted that all monetisation of capital depends on a number of controversial assumptions:

- *Market prices and the functioning of markets*. In some cases market prices are available that are used as a proxy in the valuation of capital stocks. Underlying this approach is the assumption that the market price is reflective of a perfectly functioning market. [17]
- *Weak sustainability*. The assumption on market prices implies that there is perfect substitutability between the various stocks of capital. Their relative scarcity is simply reflected in their prices. This perspective is known as weak sustainability. Many however advocate that strong sustainability which assumes that the possibilities for substitution between different capital stocks are, and therefore monetisation, are limited. Particularly the the critical natural capital stocks are often cited as irreplaceable (WGSSD report, page 56-57).
- *Discount rates*. In the valuation of capital future, income streams from capital stocks are estimated. The net present value of these income flows are calculated using a discount rate. Debate over the appropriate discount rate has a long history. The Stiglitz report discusses the ethical aspects of discounting over the generational boundaries. This assumption is empirically very important because a small difference in discount rate can sometimes make a large difference to the value of the capital stock.
- *Technical progress*. To estimate future income streams assumptions are commonly made about the productivity growth in the coming years or even decades. Also assumptions have to be made about the lifetime and efficiency of the capital stocks in future. These type of predictions are very difficult make.

Statistics Netherlands is cautious when it comes to monetisation. Of course, part of the capital stocks which are already monetised within the System of National Accounts (Physical capital, R&D capital, financial capital) can also appear in a monetised form in a SDI set. For human of capital experimental work is being done also in conjunction with the OECD project on Human Capital Accounts. .

[17] The WGSSD report notes that the functioning markets rarely achieve the ideal conditions economists impose upon them in their valuation methods (WGSSD report, pages 54-55, box 3). The Stiglitz report also acknowledges that the right valuation of the stocks of capital is often problematic, in particular "when market prices for assets are not available or subject to bubbles and bursts" (Stiglitz report, recommendation 3, §24). It states that "The monetary approach requires imputations and modelling which raise informal difficulties" (Stiglitz report, recommendation 11, §38).

4. Conceptual framework

4.1 Basics

The overviews in the previous two sections show that the last two decades have seen the emergence of many ways to measure sustainable development and societal progress. It also discussed the major debates that are still unresolved. Looking at these debates from the perspective of the international statistical community, one can see that a consensus is emerging when it comes to measuring sustainable development:

- Most countries opt for a broad perspective of sustainable development, not just focusing on environmental issues;
- Most statistical agencies refrain from working with composite indicators, but rather chose to chart sustainable development using a *set of indicators*;
- The statistical community is hesitant about monetisation (with the exception of some economic phenomena) and
- Most institutes subscribe to the integrated view rather than the future oriented view. All three dimensions of the Brundtland report, "here and now", "later" and "elsewhere", are therefore covered.

Despite the convergence in these debates, the existing SDI sets still differ significantly. This is because the conceptual basis for each indicator set, which governs the choice of themes and indicators, varies greatly. Some indicator sets go through extensive stakeholder consultations, while others are based on conceptual literature.

Despite the differences in current SDI sets, there is some prospect that future instalments of the SDI sets might start to converge towards one conceptual approach. There is reason for some optimism as international groups that have looked at the conceptual discussions (WGSSD, TFSD and Stiglitz report) have all come up with similar conceptual frameworks that are based on economic theory, but enriched with the insights from other social sciences. This section will discuss such a conceptual framework, which is consistent to the Brundtland report, but at the same time can be linked to a wide range of academic literature.

The work of Statistics Netherlands follows these four directions mentioned at the beginning of this section. Based on these ground rules a conceptual measurement

system has been constructed. The most important aspects of the theoretical foundations of the work of Statistics Netherlands are:

- Brundtland report.
- Broad perspective on welfare (*in Dutch: het brede welvaartsbegrip*).
- Consistency with the Stiglitz report (and its focus on economic theory)
- Inclusive of other social science literature.

The theoretical and statistical literature that is relevant to our conceptual measurement system are discussed in the remainder of this section.

The Brundtland definition which states that sustainable development is a development which "meets the needs of the present without compromising the ability of future generations to meet their own needs", implies that the wellbeing of future generations must be safeguarded by making sure that they have sufficient resources at their disposal, while at the same time securing the wellbeing of the current generation across the planet. The issue of sustainable development thereby becomes a matter of intergenerational equity which is determined by the distribution of capital over time. The same applies to the intra-generational aspects of capital use. The Brundtland report put quite some emphasis on the fairness of societal developments on a global scale.

According to the Brundtland report the core of the debate on sustainable development concerns the trade-offs between the present generation pursuing its welfare goals in the 'here and now', yet leaving enough assets for future generations as well as people elsewhere on this planet, to pursue *their* wellbeing. The fairness of distribution can therefore be considered to be a vital part of the discussion on sustainable development.

It is clear that the wellbeing of present and future generations crucially depends on how society uses its resources. These resources or assets are estimated on the basis of the so-called capital approach, which does not only refer to the economic capital that is taken on board in the System of National Accounts, but which also includes non-market natural capital, human capital and social capital.

Fortunately, there is a huge body of literature on capital and its impact on welfare on the basis of which indicators can be chosen. Essentially, the capital literature goes back to the work of Hicks (1939) who argued that the (material) welfare of countries can only be guaranteed as long as the amount of capital (per capita) does not

decrease. It is interesting to notice that in these earliest contributions to capital theory, the intergenerational aspects of welfare were that strongly emphasised.

In his work on the aggregate production function, Solow (1956) demonstrated the importance of capital in stimulating GDP growth. He argued that it is essentially the growth of capital intensity (=the amount of capital per unit of labour) which serves as engine of economic growth. In the oldest streams of capital and growth literature the concept of capital was confined to the so-called economic or *produced* capital (such as machinery and equipment, infrastructure). This type of capital was included in the SNA at a relatively early stage.

From the 1960s onwards empirical economists started to re-think the concept capital and came to the conclusion that the focus on economic capital (essentially machinery, equipment and infrastructure) was too narrow. There were other types of assets which also were beneficial to GDP growth and which should be included in the capital concept. The first addition to the production function was human capital, which focuses on the quality of labour (mostly in terms of educational attainment). At later stages also natural capital (subsoil assets, but also global stocks such as biodiversity and a healthy atmosphere) and knowledge capital (resulting from among others investments in Research and Development, R&D) were included in the capital concept. Some of these assets (subsoil assets and R&D) are (about to be) part of the system of national accounts (SNA) and the System of Economic and Environmental Accounts (de Haan, 2004; SEEA, 2003). The most recent addition is social capital. This concept focuses on the quality of inter-personal relationships and networks and analyses the welfare effects of several types of networking.

More recently, research has shifted from broadening the capital concept to initiatives to go “Beyond GDP”. Of course, GDP should not be regarded as a measure of wellbeing. However, the idea of linking wellbeing to a set of assets which are needed to generate the goals that societies aspire to is important as it enables us to discuss issues of current and future welfare in one coherent framework. In a way academia is moving toward a broader production function in which human wellbeing is linked to a broad capital concept. Figure 1 shows how human wellbeing is related to its resources (the different types of capital).

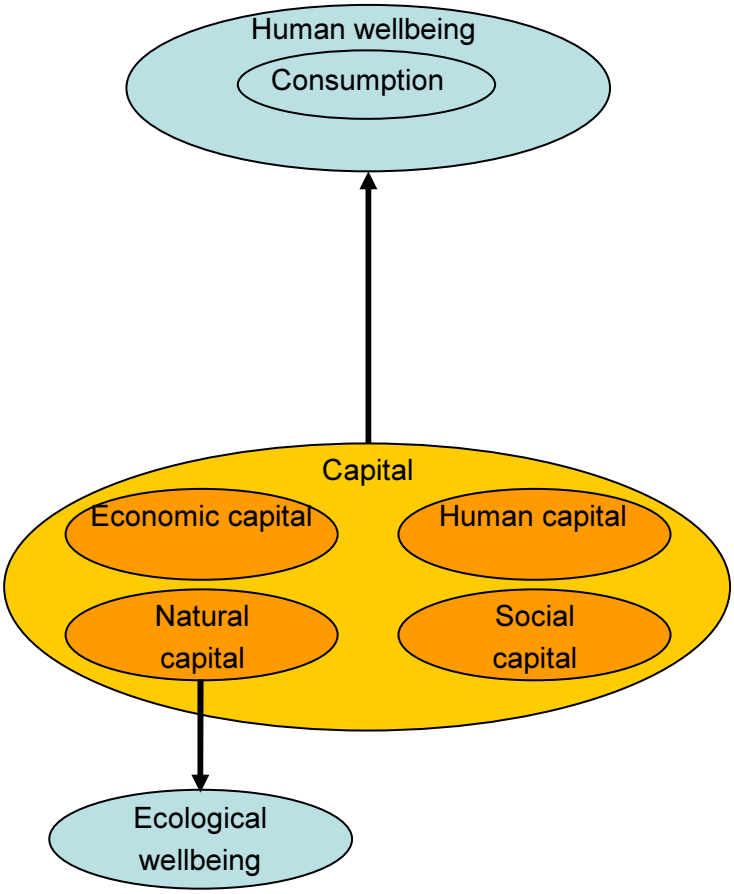

Figure 1. Capital and human wellbeing

Human wellbeing: A broad concept which is not confined to the utility derived from the consumption of goods and services, but which is also related to people's functionings and capabilities (i.e. the freedom and possibilities they have to satisfy their needs).

Consumption: Represents the utility consumers derive from the use of goods and services, in the system of national accounts measured in terms of final household consumer expenditures.

Ecological wellbeing: A concept which focuses on the intrinsically value of nature and its ecosystems, not necessarily reflected on the value these systems have for human beings.

Sustainable Development: A development that meets the needs of the present without compromising the ability of future generations to meet their own needs

Human wellbeing is seen as the overarching concept reflecting all those issues which increase the quality of life of human beings. Consumption can be seen as a sub-set within this overall concept of human wellbeing.[18]

It should be noted that human wellbeing is a much broader concept than consumption. Consumption exclusively focuses on the command that people have over commodities. Human wellbeing is broader in the sense that it states that having certain commodities at ones disposal may not be enough to generate wellbeing. We need to be free and able to use these commodities in such a way that they truly help us to satisfy our needs. This perspective relates to the 'functionings and capabilities' which are strongly stressed by Amartya Sen (1993). Here also the freedom and possibilities that people have to satisfy their needs are taken into account. Besides, human well-being can also be determined by other factors than the command over commodities/ the consumption of goods and services. Also psychological, biophysical and socially-related phenomena are of paramount importance in people's feelings of wellbeing.

Society has a number of available resources [economic capital (machines and buildings), human capital (labour, education and health); natural capital (natural resources, biodiversity and climate) and social capital (social networks, trust and institutional capital)]. These resources are necessary to maintain human wellbeing.

Natural capital is a special type of resource because it is a *critical* capital stock. Without it humans could not exist. It is also important to note that the above discussion of quality of life and wellbeing is very anthropocentric: natural capital is only of value to society if it provides ecological services that benefit humans. In the literature many authors argue that certain types of natural capital, such as biodiversity, have an existence value, irrespective of its use by society. This aspect is represented by introducing the term "ecological wellbeing" in figure 1.

4.2 Detailed Causalities "Now versus Later"

Figure 1 is a static representation of human wellbeing. However, it does not show whether the wellbeing can be maintained towards the future. From an inter-

[18] Note that human wellbeing is the overarching concept and that consumption and other common concepts such as subjective wellbeing and material wellbeing can all be regarded as narrower and imperfect. For the sake of clarity we have restricted the figure to the broadest and narrowest concepts.

generational perspective sustainable development is development that ensures non-declining per capita national wealth by replacing or conserving the sources of that wealth; that is, stock of produced, human, social and natural capital. It should be pointed out that in this definition only the *potential* for sustainable development as there are no guarantees that future generations will manage the capital stocks in an appropriate manner. However, while stable or growing total wealth per capita is no guarantee of sustainable development, the opposite is a guarantee of its impossibility. That is, in the face of declining per capita capital stocks, wellbeing will in the long run deteriorate and sustainable development will not be possible.

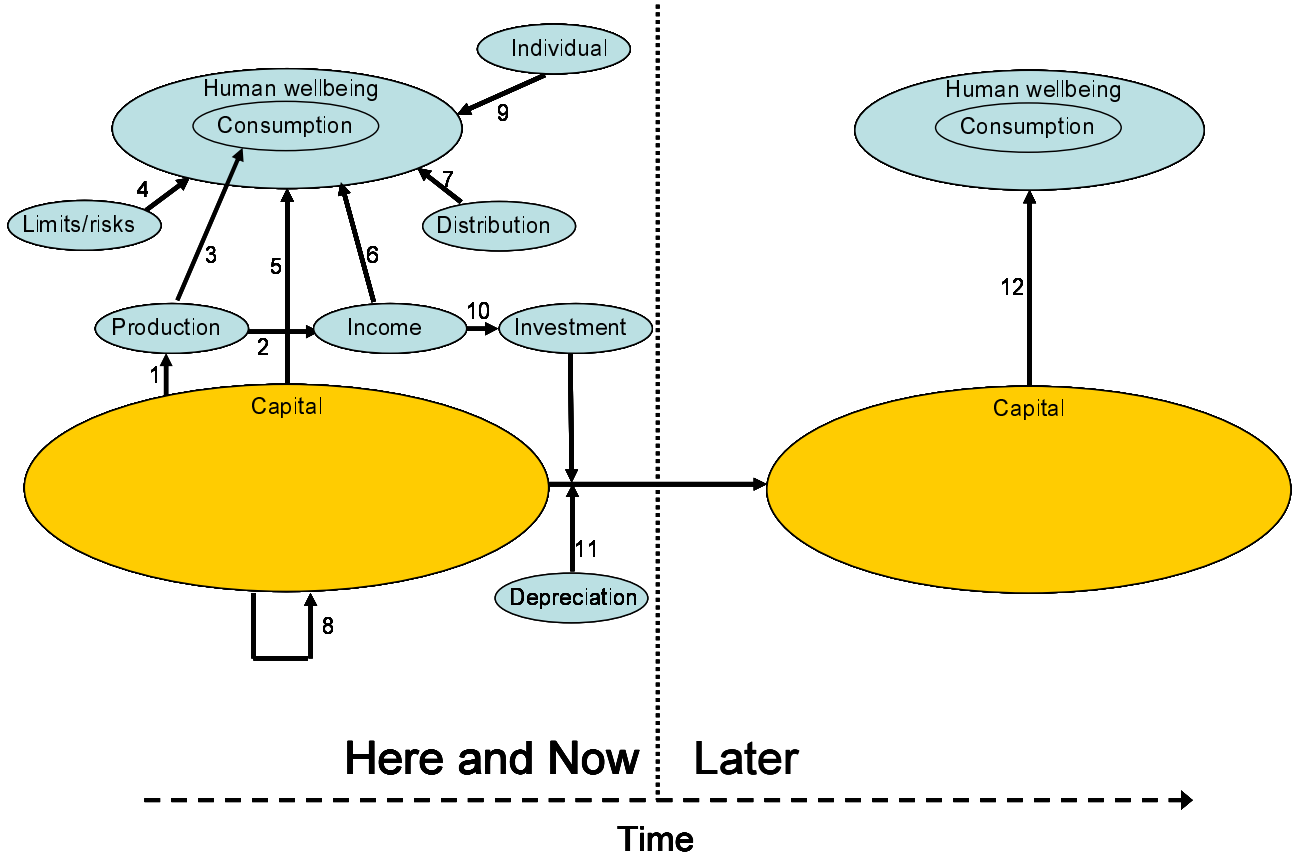

Figure 2. Sustainable development: Now versus later

Figure 2 identifies the main determinants of human wellbeing and sustainable development and also takes the time perspective into account:

[1] Goods and services are produced in production processes which use resources (or capital). In economics this is known as the production function.

[2] In the production process the factors of production are rewarded, thereby providing income.

[3] The produced goods and services are consumed which provides "utility". The sum of the utility from consumption of all persons is referred to as the "welfare" in economics (note that this report uses a broader notion). In economics it is common to model the preferences of individuals using a utility function.

The first four steps are common to the standard neoclassical model in economics. It however needs to be expanded in a number of ways:

[4] Limits/risks: Having command over certain commodities may not necessarily lead to higher levels of wellbeing. People need to be able and have the freedom to get access to these commodities and to use them properly. Sen strongly emphasises the importance of such capabilities. In a way this approach goes back to the work of Maslow who indicated that limits and risks may fundamentally impact on people's wellbeing.

[5] Capital has a direct effect on human wellbeing (as opposed to the indirect effect through the production of goods and services). For example, individuals with a high level of human capital (either a high education level or good health) exhibit higher levels of well-being, even when corrections for income and other factors are made (Lomas, 1998; Healy, 2001).

[6] Human wellbeing is also correlated to income. However, there is also ample evidence that the relative income level to peer and family group members is most important (see [9]).

[7] As the Stiglitz-Sen-Fitoussi-report stresses the distribution of capital, income and consumption is an important cross-cutting issue in studies of human wellbeing. National averages can often hide the large difference within demographic groups in a country. High inequality can also affect social cohesion, and thereby human wellbeing.[19]

Happiness literature and experimental economics has shown that the wellbeing of a person is affected by his/her relative income with respect to other persons in his/her social circles (Helson, 1964; Smith et al, 1989; Lucas and Diener, 2000 and Hagerly, 2000). Happiness literature also shows that well-being is dependent on the time elapsed. Reaching a certain goal in life

[19] Sociological literature states that social cohesion is determined by social capital (e.g. social participation and trust) and the degree of inequality.

provides a temporary spike in wellbeing, but this effect wears of soon afterwards (Stiglitz and Becker, 1977; Becker, 1996 and Bowles, 1998).

[8] The different capital stocks are interrelated. Growth of one capital stock can lead to more productive use of other types of capital for example. This is particularly true for social capital, which is seen as an enabler of other resources. However, there are also capital complementarities between physical and human capital: new machines will also require new skills in the population (see Goldin and Katz, 1999).

[9] Finally, wellbeing is not only affected by scarce resources but also individual psychological characteristics and information availability (Zajonc, 1980; Argyle 1987; Kahneman et al., 1994; Bradburn, 1996; Lewin, 1996; Deneve and Cooper, 1998).

The discussion of figure 2 clearly illustrates that there are many mechanisms through which the human wellbeing is affected. In the conceptual model terminology is used that is common to economic measurement, but at the same time the rather limited causalities in economics are enriched by other fields of scientific enquiry.

[10] Part of the income from production processes is used for consumption [3] while the other portion can be invested in capital stocks. Since this can be used in future production processes this is often referred to as “delayed consumption”.

[11] The new level of a capital stock is determined by the investments but also by depreciation and other changes (for example discoveries of new oil fields) in the capital stocks.

[12] The resulting level of capital stock can be used by future generations for their own wellbeing. For economic and natural capital it is quite easy to see that capital stocks can be left for future generations. But how about human and social capital, assets that are intrinsically ‘linked’ to the peoples of this generation? For knowledge capital (such as R&D) as well as social and social capital it is important to bear in mind the mechanisms of path dependency. Choices that societies make have long-run effects. Due to the huge investments which are made in building up institutional frameworks (relating to different areas such as the knowledge system –national system of innovation- or civil society structures etc etc), there are high and sometimes even prohibitive transaction costs involved which may make it hard for

societies to break away from the existing structures and move to new ones. Such radical regime shifts are quite rare, at least in the western world. It is also for this reason that investments in social capital are not only relevant for the current generation, but probably also impact on the wellbeing of the next generation.

4.3 Detailed causalities "Here versus elsewhere"

Most of the sustainable development literature focuses on intergenerational aspects. However, the Bruntland argued that given the large disparities in the standard of living between countries, there is an important international dimension to sustainable development. Also the increased globalisation, implies that the economic prosperity and the environmental consequences are also increasingly intertwined.

The central question is whether, in pursuit of the wellbeing of one country, the wellbeing (or future wellbeing) of other countries is negatively affected. Conceptually, the international dimension of sustainable development is very broad. Ideally, one would prefer to monitor all the mechanisms in which a country may have an impact on the wellbeing (both current and future) of all other countries. However, it should be kept in kind that even on the national level, not all causalities between human wellbeing and the broad capital concept are fully understood. In the international setting these causalities become even more complex.

Figure 3 shows the relationships between capital and human wellbeing in a global context. It is visualised in a similar way as figure 2. Apart from the national capital stocks it however also contains the concept of global capital, of which the climate system probably is the best example. No country "owns" the atmospheric system, but at the same time each country contributes to climate change through (current and past) emissions of greenhouse gas emissions. As will be discussed later in this section, there are several ways to look at the ethical responsibility for these emissions.

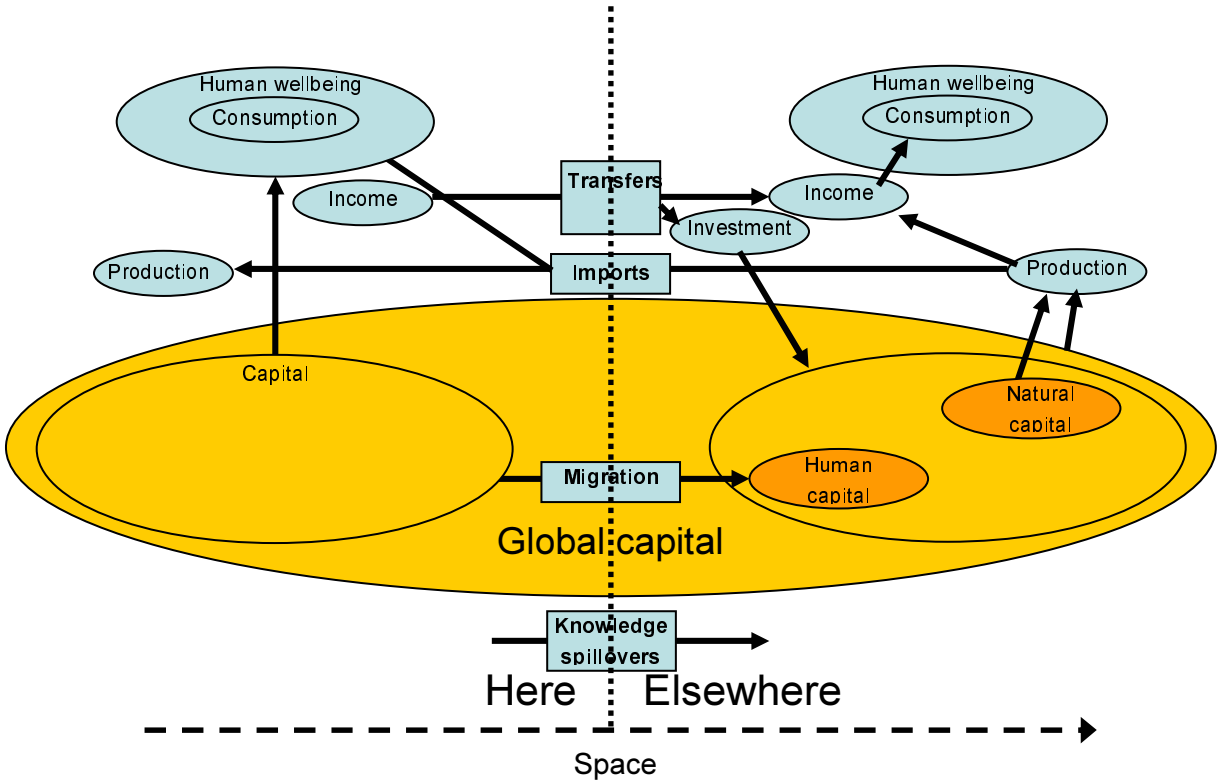

Figure 3. Sustainable development: Here versus elsewhere

Figure 3 identifies a number of important ways in which a country may affect other countries:

- *Financial flows/transfers.* For a variety of reasons money may be transferred from one nation to the other. The reasons may be humanitarian or developmental (Official Development Aid: ODA) or simply be the repatriation of money of foreign nationals to their home country (remittances). A country might also be inclined to grant loans to foreign countries or to invest through foreign direct investment. All these financial transfers have varying impacts on the current and future wellbeing of the receiving country (and the donating country for that matter).
- *Imports.* Probably the most important link between countries is the international trade in goods and services. Importing commodities (for consumption or to be used in the production process) provides the other country with income (and therefore consumption possibilities). The importance of international trade for economic prosperity has been subject to academic research for many centuries (Ricardo, Hecksher-Ohlin, Krugman). However, in the context of sustainable development it is also important to realize that the production of the goods and services is associated with the use of capital stocks, and in particular the use of

natural capital. Through these imports, "here" therefore has an impact on capital stocks such as natural resources "elsewhere".

- *Migration.* Of course, when people migrate or relocate temporarily to other countries their human capital (education, health) is also transferred. Some developing countries are confronted by the so-called "brain-drain", whereby young, well-educated members of the work force seek employment in other countries.
- *Knowledge transfers.* Technological progress is vitally important for economic growth. One component of knowledge is that "spillovers" from one country to the other may occur. There is a variety of channels through which these spillovers may occur. Technology may be embodied in the capital goods that are imported, through the knowledge of persons, or through co-operation on international R&D and patenting. International takeovers, mergers or foreign direct investments are of course great catalysts of the above effects.

Although these are all important mechanisms, the literature on the international dimension of sustainable development has mainly focussed on two aspects: the depletion of natural capital and the impact of high income countries on the wellbeing of the LDC's. This is partly because these are obviously important dimensions of the sustainable development debate and partly also because there are indicators available for these topics.

Impact on natural capital

There is a growing literature in which the international dimension of natural capital flows is being investigated. There is now evidence that some countries may be "exporting" their environmental pressures: their domestic emission are staying stable or reducing, but are being compensated by GHG intensive imports. These countries are therefore affecting the global climate system through emissions abroad. This type of shift is also known as *carbon leakage* (Copeland and Taylor, 2005, Babiker, 2005, Chen, 2009). It is however also related to other debates such as the *pollution haven hypothesis* or *race to the bottom* (Cave and Blomqvist, 2008; Michida and Nishikimi, 2007; Cole, 2004), in which it is postulated that the developing countries are increasingly attracting polluting industries that are relocating from the developed world because of environmental regulations or other reasons. This enables developed countries to emit fewer pollutants, but at the expense of the environment elsewhere or the global capital stocks.

It must be stressed that the empirical evidence for these phenomena is mixed. In some cases there are examples that confirm these shifts in environmental pressures (Dam and Scholtens, 2009), while in other cases the hypotheses are falsified (Fæhn and Bruvoll, 2009; Chintrakarn and Millimet, 2006; Dietzenbacher and Mukhopadhyay, 2006).

Impact on LDC's

The problem of global poverty, which was stressed in the Brundtland report, is one of the most important issues in the international dimension of sustainable development. The relationship of rich developed countries with LDC's is, however, a complex one. Ideally one would want to measure the net impact on the (current and future) human wellbeing of the LDC's is positive or negative. Only then could one reach a conclusion that a country is not building up its own human wellbeing at the expense of other countries. This type of aggregation is clearly beyond the current methodologies. It is therefore inevitable that the different mechanisms are analysed separately.

It is useful to make a distinction between current and future wellbeing of the population in LDC's. One of the ways to stimulate current human wellbeing in developing countries is through economic development. Developed countries may affect these through "trade and aid", although in some cases institutional support may be even more effective. Development assistance, the existence of trade barriers and the total trade with developing countries are therefore good indicators regarding the effects of trade on the current welfare of LDC's.

There are however two caveats. Firstly, these measures do not say anything about where the benefits of trade and aid will end up. In some, often institutionally weak, societies a sizeable portion of the profits may accrue to a small minority of the population or go to large multinationals. These are distribution effects which have a negative impact on the broad concept of human wellbeing. Secondly, the trade of goods and services can be unsustainable, from an intergenerational point of view, because the LDC's are depleting their capital stocks.

The latter point is clearly made in Worldbank research on genuine savings. Many LDC economies exhibit positive economic growth but do so by depletion natural resources. In fact, a large group of these countries suffer from a "resource curse" (van der Ploeg, 2011), in which the proceeds of these capital stocks are not invested

according to Hartwick's sustainability rule (World Bank, 2011). This means that even if it is concluded that western countries are contributing to the current economic growth in these countries, and thereby reducing international poverty, it is important to also see how they are contributing to the depletion of natural resources. The situation could occur that a western country is contributing to reductions in current global inequities, but contributing to growing inequality in the future.

5. Classification scheme

The previous section dealt with the three dimension of the Brundtland Report: human wellbeing in (i) the 'here and now', (ii) 'later' and (iii) 'elsewhere'. Yet, it has not been described which themes are important in each of these three dimensions. This section will therefore present a list of themes, a classification scheme. Section six will then provide indicators for these themes.

5.1 Human wellbeing ('here and now')

The concept of human wellbeing has many different connotations, because it is covered in a wide range of scientific fields (economics, psychology, "happiness literature" etc) in which different labels are being used.

Traditionally, economists have followed a welfarist approach in which wellbeing is related to the utility that people derive from consumption. In practice, the concept of utility is interpreted in terms of people's 'revealed preferences' and charted on the basis of the observation of the actual choices that people have made. Therefore, the more conventional way to describe human wellbeing is by charting people's consumption (food, clothing, shelter), their health status and educational attainment and other so-called 'objective factors'.

This utility approach is severely criticised. Sen (1985) warns that approaches focusing on the resources that individuals have at their disposal may be too fetishist about external resources and thereby neglecting that different individuals have unequal abilities to transforming resources into wellbeing. Sen (1993) conceptualises the objective aspects of human wellbeing by means of the 'functioning and capabilities approach'. The functionings refer to the activities and situations that people spontaneously recognize to be important. In more practical terms, these functionings can be conceived as a collection of the observable

achievements of each person, objective factors relating to a wide range of factors such as education, health etc. But it is important to look beyond these achievements, to include the full range of opportunities open to people. It is for that reason that Sen strongly emphasizes the importance of freedom in his work. The more freedom people have, the more capabilities they have to increase their range of opportunities. The key issues that are at stake here concern the empowerment of people, meaning that individuals should be seen as actors of their own development.

Besides, happiness literature has become quite influential in the field of measuring human wellbeing (Frey and Stutzer, 2000; Frey and Stutzer, 2002a and b; Diener and Oshi, 2000; Easterlin, 2001; Charness and Grosskopf 2001; Deci and Ryan, 2001; Hagerty and Veenhoven, 2003; Bruni and Porta, 2005; Veenhoven, 1993, 1996 and 2000b; WDH 2003). This tradition argues that also the ways in which people value their life (in terms of their happiness and life satisfaction) should be integral part of any investigation into human wellbeing. The quantification of human wellbeing should therefore not be restricted to what people chose to consume and how it affects their health, educational level etc etc. Also the extent to which people value these outcomes are relevant. It is for this reason that the statistical community devotes a lot of time to develop indicators on subjective wellbeing.

Ideally, a dataset on human wellbeing should include both objective and subjective aspects. In the ideal case surveys should incorporate questions to capture people's life evaluations, hedonic experiences and priorities. These surveys should also enable the users to chart inequalities in all domains of quality of life. Furthermore, it is important that the different inequalities are being described in a comprehensive framework, because inequalities in different fields may have a cumulative effect. Unfortunately such a systematic compiling and comparison of subjective and objective statistics is beyond the scope at the moment as it would require the building up of new statistical information systems to compile such information in a systematic and comprehensive manner.

The dashboard on human wellbeing tries to do justice to the different strands of literature (welfarist/utility approach, happiness literature and Sen's capability approach). This is clearly reflected in the choice of 'overarching indicators' in table 1. The happiness literature is represented by an overall, subjective, indicator which stresses the ways in which people perceive their quality of life. Here wellbeing is measured in terms of life satisfaction or happiness. Apart from this rather broad

perspective on wellbeing, a more concise and restricted welfarist and utalitarian perspective is chosen by focusing on consumption. Following the recommendation of Stiglitz, Sen and Fitoussi consumption will be measured in terms of final household expenditures (Stiglitz et al., Recommendation 1&2, p. 12-13).

Of course, wellbeing should not be treated as a one-dimensional concept. In his work on *happiness*, Richard Layard (2005) identifies the main importants determinants of wellbeing, 'the Big Seven': family relations, financial situation, work, community&friends, health, personal freedom (in terms of a democratic society) and personal values (people's outlook on life). Of course, this list is not exhaustive, but empirical research shows that people's life satisfaction depends primarily on these themes.

Another attempt to identify the main determinants of wellbeing is provided by Maslow (1943) (see figure 4). He tried to formulate a needs-based framework of human motivation and behaviour. In his work he distinguished different types of human needs. The distinction of the several categories of human needs may be helpful in attempts to identify the main quality of life themes for a SDI set.

Figure 4. Maslow's pyramid of human needs

The first layer of the pyramid of human needs concerns the *physiological needs* which are required to sustain life. Food, water and clean air are among the most important (basic) physiological needs. Next, important *safety needs* such as a safe neighbourhood, medical insurance, job security and financial reserves should be mentioned.

After these most elementary needs, Maslow points at the importance of *social needs* which include elements such as friendship, belonging to a group as well as giving and receiving love. Higher up in the pyramid of human needs we find the *esteem*

needs. These needs can be internally motivating such as self-esteem, accomplishment and self respect, or externally motivating due to reputation or recognition. *Self actualisation* forms the top of the pyramid and deals with the extent to which individuals can reach their full potential. Self-actualised people tend to have motivators such as truth, justice, wisdom and meaning.

Maslow's work has been criticised on a number of points. First of all it remains to be seen if higher needs are only pursued after the ones lower in the pyramid have been realised. Besides, the hierarchy of needs can be culturally conditioned. Not every culture, in every period of time will rank the respective human needs the same way as Maslow has done in his work. These shortcomings were the direct result of the lack of empirical underpinning of Maslow's model.

Later attempts to provide empirical proof for an approach in terms of human needs such as provided by Alderfer's article "An Empirical Test of a New Theory of Human Need" have been more successful in this respect (Alderfer 1969). However, for the purpose of this report questions as to how the rank the different human needs is not of great importance. Maslow's work is most of all useful to define a number of important domains which are relevant when studying human wellbeing.

Apart from the two overarching themes, dashboard 1 focuses on the main needs of human beings. The personal needs relate to nutrition, health, housing, air quality, education and leisure time. Also income inequality is included as the relative wealth of people vis-à-vis a peer group is an important determinant of their wellbeing (see the discussion in the happiness literature).

Next to these needs which are defined at a personal level, social needs, which are related to the extent to which individuals are embedded in social networks and also reflect the quality of the governance structures and the institutional quality of society at large. In other words, it concerns the quality of the social environment. The first type of needs concerns social structures and social life. The second one relates to political voice and stresses the institutional quality of the society at large and informs us about the democratic nature of political systems.

It should be stressed that the 11 wellbeing themes that are distinguished in table 1 are included in the most important datasets on sustainable development and human wellbeing. Besides, they correspond closely with the domains of the SSF Report.[20]

Table 1 presents the dashboard on the classification of human wellbeing.

Table 1 Classification of Human Wellbeing

Classification	**Sub-classification**	**Themes**
Human wellbeing	Overarching indicators	HWB-A- Subjective wellbeing
		HWB-B-Consumption and income
	Personal needs	HWB1. Health
		HWB2. Housing
		HWB3. Air quality
		HWB4. Education
		HWB5. Leisure
		HWB6. Labour
		HWB7. Inequality
		HWB8. Physical safety
	Social needs	HWB9. Trust
		HWB10. Shared norms and values
		HWB11. Institutions

5.2 Capital ('later')

Selecting the themes which should be included in a dashboard on capital is easier than the section of themes for human wellbeing, since it can be based on a rich body of literature on capital and growth theory. Besides, some aspects of capital (parts of economic and natural capital) are already part of the statistical system (i.e. the SNA and SEEA).

Economic Capital and Financial Capital.

The measurement of these capital types is the most advanced in terms of economic thinking and its measurement in the statistical system. Section 2.1 already dicussed

[20] -1- Material living standards (income, consumption and wealth), -2- Health, 3- Education, -4- Personal activities including work, -5- Political voice and governance, -6- Social connections and relationships, -7- Environment (present and future conditions), -8- Insecurity, of an economic as well as a physical nature

the long history of the System of National Accounts, which governs the measurement of economic and financial capital. The OECD manual on "Measuring Capital" (OECD 2001) goes further in the methodology of measurement.

Economic capital is thought of as traditional (produced) tangible assets such as machines and buildings. However, produced intangibles (e.g. software), non produced tangibles (land and natural resource stocks) and non-produced intangibles (transferable contracts and purchased goodwill) are also defined as economic capital by the SNA, although statistical institutes often lack the sources to produce estimates for many of these categories. In the revision process of the SNA it has also been decided to expand the asset boundary of economic capital to include R&D..

Financial capital, in theoretical terms, is a zero-sum capital stock because for every liability there is an equal and opposite asset. However, this is a global perspective. It is of course, possible that on a national scale the assets exceed liabilities or vice versa.

The themes that are identified for economic capital are physical capital (buildings and machines and infrastructure) and knowledge capital (R&D) and for financial capital, which we included (net) financial assets.

Natural capital

This type of capital is also well developed in the academic and statistical world. Admittedly there is less agreement on scope and measurement as economic capital, but the System of Environmental and Economic Accounts (SEEA, 2003) does provide an internationally agreed starting point. The 2003-version of the SEEA is currently being updated and is expected to become a statistical standard in 2012.[21]

Even though some part of natural capital is already incorporated in the SNA and SEEA (land, subsoil assets), some non-market natural capital themes such as ecosystems (biodiversity) and the global climate system should be part of the list of capital goods. Although these are difficult to attribute to individual countries and in

[21] The SEEA is a satellite accounting system of the System of National Accounts (SNA). This means that it uses the national accounting concepts and principles to measure environmental aspects of society. In some areas, including the asset boundary, it has chosen to expand SNA thinking.

some cases notoriously difficult to measure (biodiversity)[22] they do constitute assets in the broadest send of the word.

The themes that are identified for natural capital are: energy and non-energy reserves (SNA, SEEA), land and ecosystems (SNA, SEEA), water (SEEA), air quality and climate.

Human capital

Human capital is usually associated with educational attainment, skills and experiences of the population of a country. Conceptually it is however broader and pertains to all the *individual* characteristics that contribute to the human wellbeing or material welfare. Apart from skills and competencies this therefore also includes the labour volume and health. The focus on personal characteristics also distinguishes its from social capital, which deals with the social connections *between* individuals in society (see the next paragraph).

Although in the statistical system includes many attempt to measure the quantity of labour provided, statistics on the quality of the labour force are less well developed in the National accounting sphere.

The experiments on the monetisation of human capital are strongly driven by academic research. There is a wide range of theoretical literature in this field which discusses monetary valuation methods of the stock of human capital and which deals with the economic effects of human capital accumulation (Cf. Becker 1964 and 1975; Jorgenson and Fraumeni 1995; Barro 2001 and Aulin 2004). The valuation of the human capital stock is impacted by education levels, market and non-market work vs. leisure decisions, birth rates, and health.

Monetary human capital account can be constructed using a cost based approach or the lifetime income approach. The life-time income method is also commonly known as the Jorgenson-Fraumeni approach, after its developers. The Jorgenson-Fraumeni approach is being used by the OECD human capital consortium.

[22],There are an increasing number of statistical initiatives trying to come up with measures in this field

The themes that are identified for human capital are: Labour (volume), education and health.

Social capital

From the point of view of consensus in academic and statistical circles, the measurement of social capital is the least developed of the capital stocks. The discussion of this capital stock therefore merits a somewhat longer description.

Social capital is the most recent addition to capital but its still has a fairly long academic history (Bourdieu 1986; Putnam 1993, 1995 and 2000; Fukuyama 1995 and 2000; Grootaert 1997; Dasgupta 2000 and 2002; Durlauf and Fafchamps 2004). The social capital literature shows that the networks and the trust which exist within a country are important factors which drive economic growth (and welfare in a broader sense) (World Bank 2006).

Social capital has its roots in sociology (Bourdieu 1986, Coleman 1988 and 1990), but has also become an important topic for political scientists and economists (Putnam 1983 and 1995, Fukuyama 1995). A survey of the literature reveals that social capital is a multi-dimensional phenomenon. A careful study of the literature indicates that there are four main areas of discussion which should be taken on board in a proper operationalisation:

- *Micro or macro phenomenon*. Bourdieu (1986) explicitly defines social capital as an individual asset. In his view individuals participate in social networks in order to improve their competitiveness vis-à-vis others. Putnam (1983 and 1995), however, points at the more collective characteristics of network creation.
- *Networks versus trust*. Originally, the sociologically inspired literature strongly emphasised network creation as the main aspect of social capital. On the other hand, Fukuyama (1995) puts more emphasis on the trust that is accumulated within these networks. Social networks are not a goal in itself, but rather a means on the basis of which individuals through repeated interactions are able to build trust. Putnam even labels social capital as a necessary lubricant of society. Woolcock (2001) sees trust as a result of investments in social capital. Others rather see is as a component of the shared norms and values which function as a determinant of social capital. A third group stresses the dynamic interdependency between social capital and trust (Cote en Healy 2001).

- *(Positive) external effects*. The discussion on the nature of social capital as an individual or a public good, essentially deals with the importance of external effects. Dasgupta (2003) argues that social capital should be defined in terms of a system of inter-personal relationships and strongly emphasises the incidence of external effects. In a context where repeated interaction between individuals result in the creation of general trust and the strengthening of shared norms and values, these externalities result in a decline of transaction costs which in its turn enables the social system to function more smoothly.
- *Civil society or more generic approach*. The OECD works with a 'civil society'-type of definition which focuses on networks between different social groups. The World Bank uses a much broader definition which also incorporates formal organisations such as the state. Portes and Landolt (1996) stress that the forces that bind individuals in networks might be of an entirely different nature, than the forces which allow for strong ties between citizens and the state.

A proper operationalisation of social capital should take into account these three debates:

- Social capital should be defined in terms of networks as well as the trust and the shared norms and values that are being generated within these networks. The inclusion of trust is important as it comes closer to the concept of capital in an economic sense. From an *investment perspective*, one may prefer to focus on networks (see Bourdieu: individuals invest in networks as they expect network participation to increase their competitive strength). However, capital theory also shows us that the investments result in building up a capital stock. The changes in the size of the capital stock can be followed in the course of time. From a capital *stock perspective* (following Fukuyama and to some extent Putnam), a focus on trust as well as on shared norms and values is needed. Rising or declining levels of trust can be interpreted in terms of a change in the volume of capital, whereas a change in the size of a network in itself has no meaning (a network can increase in size, while the frequency and quality of contact between its members actually declines). Even though far more difficult to measure, shared norms and values can be seen as a capital stock that is built up due to increasing social interactions.
- Social capital should refer to citizens as well as institutions. The indicators suggested for the social capital of citizens and on institutions are in line with the recommendations of the Working Group on Statistics for Sustainable Development (2009) and of the report by Stiglitz-Sen-Fitoussi (2009).

The themes that are identified for social capital are: trust, shared norms and values and institutions.

Table 2 summarises all capital themes which have been selected. This table also includes the so-called monetary aggregates. As was pointed out earlier in this paper, most statistical bureaus are quite hesitant when it comes to monetising capital. With the exception of those assets which already included in the SNA (economic and financial capital), only experimental work is done in the field of human capital and parts of natural capital. But these experiments are still far removed from the realm of official statistics. The aggregate measure economic wealth (EW-M) is a combination of those assets which are already monetised (economic and part of natural capital). The WGSSD suggested this as one of the leading indicators for the future oriented view of sustainable development.

Table 2. Classification of Capital

Classification	**Sub-classification**	**Themes**
Capital	Economic capital	EC1. Physical capital
		EC2. Knowledge capital
	Financial capital	FC1. Financial assets
	Natural capital	NC1. Energy reserves
		NC2. Non-energy reserves
		NC3. Land and ecosystems
		NC4. Water
		NC5. Air quality
		NC6. Climate
	Human capital	HC1. Labour
		HC2. Education
		HC3. Health
	Social capital	SC1. Trust
		SC2. Shared norms and values
		SC3. Institutions
	Monetary aggregates	EC-M Economic capital
		FC-M Financial capital
		NC-M Natural capital
		HC-M Human capital
		SC-M Social capital
		EW-M Economic Wealth

5.3 International dimension ('elsewhere')

Section 4.3 described a number of mechanisms through which countries may affect each others current and future wellbeing. There is no claim that this is an exhaustive list of causalities, but these are important links that are identified in the current literature.

Table 3 is based on section 4.3 and shows which themes should, from a conceptual point of view, be included in the ideal dashboard. However, the measurement is hampered by the lack of availability of data and methodologies to calculate certain indicators. As result the SDI literature has focussed on the two dimensions that are deemed to be most important: the impact on natural capital and impact of developed countries on LDC's. In the remainder of this section a short summary of the measurement issues in these two fields will be provided.

Impact on natural capital

A important development in the analysis of the international dimension is the growth in "footprint" type indicators, which will be briefly discussed here.

Basically, the emissions of a country can be represented by the following equation:

> *Emissions from domestic consumption = Emissions from domestic production + emission from imports – emission from exports*

But which emission are countries responsible for? This is clearly an ethical and political issue. Are countries responsible for the emission in the production of goods and services (even if they are made for exports) or are they responsible for the emission from domestic consumption (these emissions can either be in the country itself or in other countries)? The former is known as the production perspective and the latter as the consumption perspective (Peters, 2008; Lenzen and Murray, 2010).[23]

Increasingly, literature focuses on environmental indicators that adopt the "consumption perspective". These indicators look at the consumption in a country

[23] The emission targets of the Kyoto protocol are based on the CO_2 emissions from within the geographical borders. This is therefore not identical, but fairly close to the production perspective since many of these emissions are attributable to the industrial activities in the country.

and then analyse all the environmental pressures that have taken place upstream in the production process of the product in question. These upstream pressures can be either in the domestic economy or abroad. Note that there are two types of consumption indicators, which differ in the range of upstream effects that are taken on board.[24]

In the last decade or so the amount of techniques and the necessary data has expanded significantly. These developments are based on "input-output techniques" which was first introduced in the 1960s, but has recently experienced a resurgence. These input-output methods have also started to be adopted at various NSI's which are now producing them on a regular basis (see for example Lenglart et al. 2010).[25]

Impact on LDC's

In section 4.3 the importance of assessing the impact of developed countries on LDC's has already been stressed. Also the effort to distinguish the effects on the current and future human wellbeing of those countries. Indicators on "trade and aid" will primarily affect current wellbeing. Imports of natural resources can have a positive effect on current wellbeing because of the income that it generates, but at

[24] *Direct upstream effects.* The best known example is the ecological footprint or related measures such as the water footprint. In these indicators the domestic consumption of a country is valued in land area or water consumption respectively. For example, growing foodstuffs uses a certain amount of water so the quantity of food consumed is multiplied by the water required per unit. Only the water that is used for the land on which the crops are grown is taken on board. This is known as the direct use.

Direct and indirect upstream effects. In these types of indicators the indirect upstream effects are also taken on board. These are the other effects that occur in the earlier stages of the production process. For example, in the above example of the water footprint, the water which is used to irrigate the crops is incorporated, but the agricultural production process requires a lot more inputs. There are various input required such as machinery, fertilizer and seeds. The production processes of these inputs also require water, but they also require more intermediate inputs with require more water, and so on and so forth. The consumption of the food in one country therefore provides an impulse to an (in theory infinity) amount of production processes. In all the processes water is used and should be attributed to the consumption.

[25] The calculation of these indicators is expected to become even easier because some new datasets are currently being developed. The calculations require a multi-regional input-output table augmented with environmental data. There are a variety of sources available and on the way (for an overview see Wiedmann et al, 2011): GTAP; OECD (Ahmad and Wyckoff, 2003; Nakano et al., 2009; WIOD (www.wiod.org), EXIOPOL (http://www.feem-project.net/exiopol/index.php), ASHIA (Lenzen etal., 2010).

the same time leads to a reduction of the natural capital. If the resources, as is often the case in countries with poor institutions, this can lead to the resource curse.

Table 3 shows the classification scheme that is adopted for the international dimension. Note that three categories: Labour, Knowledge and Institutions are included but that there are very few viable indicators for these themes. Labour might include indicators for the 'brain drain'. Only the Swiss SDI set has an indicator for multinational treaties which might be thought of as global institutional capital. The development of indicators in these areas should be of great interest. In future, other themes such as social capital or issues such as child labour might also be included.

Table 3. Classification of the international dimension

Sub-Classification	**Theme**	**Domestic**	**Country/Region 1**	**….**	**Country/ Region n**	**LDC's**
Overarching	INT1. Consumption & income					
Natural capital	INT 2. Energy resources					
	INT3. Non-energy resources					
	INT4. Land and ecosystems					
	INT5. Water					
	INT6. Climate					
Human capital	*INT7. Labour*					
Economic capital	INT8. Physical capital					
	INT9. Knowledge capital					
Social capital	*INT10. Institutions*					

The themes in italics are conceptually relevant but there are very few indicators available.

5.4 Classification scheme

The previous section provided an overview of the conceptual literature and identified the themes that should be incorporated in an SDI set. Table 4 summarises the results.

The list of sustainable development themes will be adopted for the remainder of this paper. It has 21 categories as well as six monetary aggregates (shown in italics).

The table also shows the "here and now, later, elsewhere" dimensions of sustainable development. Note the overlap that sometimes exists. For example, education and health are themes for human wellbeing, but are also both elements of human capital.

Table 4. Classification scheme

Theme	**Code**		
	Human wellbeing	**Capital**	**International dimension**
Subjective wellbeing	HWB-A		
Consumption and income	HWB-B		INT1
Leisure	HWB5		
Inequality	HWB7		
Physical safety	HWB8		
Housing	HWB2		
Labour	HWB6	HC1	INT7
Education	HWB4	HC2	
Health	HWB1	HC3	
Trust	HWB9	SC1	
Shared norms and value	HWB10	SC2	
Institutions	HWB11	SC3	INT10
Energy reserves		NC1	INT2
Non-energy reserves		NC2	INT3
Land and ecosystems		NC3	INT4
Water		NC4	INT5
Air quality	HWB3	NC5	
Climate		NC6	INT6
Physical capital		EC1	INT8
Knowledge capital		EC2	INT9
Financial assets		FC1	
Monetary aggregates			
Economic capital		EC-M	
Financial capital		FC-M	
Natural capital		NC-M	
Human capital		HC-M	
Social capital		SC-M	
Economic Wealth		EW-M	

5.5 Conceptual and Thematic Categorisation

From table 4 it is clear that there are two ways to structure an SDI set:

- *Conceptual categorisation*: In this SDI set the dashboard is split into the three conceptual categories Human wellbeing in the "Here and now" (Human wellbeing), "Later" (Capital) and "Elsewhere" (International Dimension).

- *Thematic categorisation*. In this categorisation the 21 themes are the basis for organising the dataset. It is also possible to introduce clustering along the social/environment/economic (people/planet/profit) or any other dimension.

Note that both these categorisations are linked to the 21 themes that were derived from the measurement theory in section three. Although the thematic classification can be seen as the more policy-oriented, it still has clear link to the conceptual framework.

Conceptual categorization

Table 5 presents the conceptual categorisation of sustainable development themes.

Table 5. Conceptual categorisation

Classification	**Sub-classification**	**Themes**	**Indicator**
Human wellbeing	Overarching indicators	HWB-H1-Subjective wellbeing	
		HWB-H2-Consumption and income	
	Personal needs	HWB1. Health	
		HWB2. Housing	
		HWB3. Air quality	
		HWB4. Education	
		HWB5. Leisure	
		HWB6. Labour	
		HWB7. Inequality	
		HWB 8. Physical safety	
	Social needs	HWB 9. Trust	
		HWB 10. Shared norms and values	
		HWB 11. Institutions	
Capital	Economic capital	EC1. Physical capital	
		EC2. Knowledge capital	
	Financial capital	FC1. Financial assets	
	Natural capital	NC1. Energy reserves	
		NC2. Non-energy reserves	
		NC3. Land and ecosystems	
		NC4. Water	
		NC5. Air quality	
		NC6. Climate	
	Human capital	HC1. Labour	

		HC2. Education	
		HC3. Health	
	Social capital	SC1. Trust	
		SC2. Shared norms and values	
		SC3. Institutions	
	Monetary aggregates	*EC-M Economic capital*	
		FC-M Financial capital	
		NC-M Natural capital	
		HC-M Human capital	
		SC-M Social capital	
		EW-M Economic Wealth	
International dimension	Consumption and income	INT1. Consumption and income	
	Natural capital	INT2. Energy reserves	
		INT3. Non-energy reserves	
		INT4. Land and ecosystems	
		INT5. Water	
		INT6. Climate	
	Human capital	INT7. Labour	
	Economic capital	INT8. Physical capital	
		INT9. Knowledge capital	
	Social capital	INT10. Institutions	

As was discussed in section 3, there are various debates in the field of measuring sustainable development. There is the integrated approach versus the future-oriented approach and there is also a discussion about the possibility to monetize capital stocks. Depending on the perspective of sustainable development that one chooses, the entire capital dashboard or a only a selection of it can be taken.

- *Integrated approach.* In this approach, all dimensions (here and now, later, elsewhere) are considered to be part of sustainable development. Therefore the whole of table 5 is included in the integrated view. However, in practice institutes that subscribe to the integrated view also have a tendency to be sceptical of monetisation. It is therefore conceivable that the monetary aggregates are excluded (dark shaded areas).
- *Future oriented approach.* In this approach, a narrower definition of sustainable development is adopted by only looking at the "later" dimension i.e. the capital measures. However, there are two varieties of the capital approach:
    - *Hybrid capital approach.* In this approach mostly non-monetary indicators are used (lightly shaded area).

- *Monetary capital approach.* In this approach all capital stocks are monetized (area shaded darkest). If one add up all the monetised values one gets an overall indicator, economic wealth.

Thematic categorization

Table 6 shows what the dashboard would look like in the case of a thematic categorization. In it, the 21 themes are listed.

Table 6. Thematic categorisation

Theme	**Indicator**
Subjective wellbeing	
Consumption and income	
Leisure	
Inequality	
Physical safety	
Housing	
Labour	
Education	
Health	
Trust	
Shared norms and value	
Institutions	
Energy reserves	
Non-energy reserves	
Land and ecosystems	
Water	
Air quality	
Climate	
Physical capital	
Knowledge capital	
Financial assets	
Monetary aggregates	
Economic capital	
Financial capital	
Natural capital	
Human capital	
Social capital	
Economic Wealth	

The themes could also be clustered under some headings. One could perhaps identify environment/social/economic split which is often seen in sustainable development literature. More popular terminology would be "people/planet/profit". Note that both aforementioned categorisations do create problems because the split between social and economic themes is not always unambiguous.

Another option but some themes could also be merged. For example, energy and climate are very much related and could therefore be merged into one theme "climate and energy". Similarly the themes education and knowledge could be merged into a "knowledge society" theme.

Advantages of the conceptual categorisation

Confrontation "here & now", "elsewhere" and "later". The primary advantage of the conceptual categorization is that it enables the user to immediately to detect the fundamental trade-offs between human wellbeing in the "here and now", "elsewhere" and "later". The thematic presentation, which is more prevalent amongst the existing SDI sets, makes it difficult to track down the these fundamental trade-offs of human wellbeing between the current and future generations, or between people living in high income countries versus those living in the developing regions. This conceptual monitoring system will therefore serve the purpose to identifying the main problematic areas.

Close connection to measurement theory and modelling. The classification into human wellbeing, capital and the international dimension is closely linked to the measurement theory presented in section three and is consistent with the recommendations of the Stiglitz report. This also means that when expansions of the system, such as satellite accounts or household accounts, are in question they are better suited to this structure. Also, the conceptual approach has the advantage that it is more amenable to modelling exercises because of its link to economic theory.

Advantages of the thematic categorisation

Terminology of policy makers. In the thematic approach the classification system is more suited to the language and societal dimensions which policy makers recognize. Note that just because a thematic approach is adopted it does not mean that it is not a conceptual approach. Clearly all themes are still connected to the themes which were derived from measurement theory in section three.

Sub-indicators for policy. The thematic approach also makes it far easier to introduce sub-indicators which give additional information and which are aimed at giving policy makers the tools to reinforce existing positive trends or to reverse negative trends. For example, next to the capital stock indicators, information on investments or efficiency (productivity) may be added, as they give additional information as to how society can develop towards a more sustainable growth path.

The use of one or both categorisations

In a way the conceptual and thematic categorisation can be seen as complements. The conceptual set aims at monitoring the main trade-offs while the thematic set tracks the progress and sub-indicators for individual policy themes. Both these presentation styles (conceptual and thematic-policy oriented) are conceptual approaches. They can be used in combination, but it is also possible to select only one of them.

5.6 Comparison to existing SDI sets

Table 8 identifies to what extent the themes suggested in this paper are already part of existing SDI sets.[26] We have made an inventory of indicator sets of the main institutes (United Nations, Eurostat, OECD and the World Bank as well as eight of the ten countries that participate in the Taskforce for Measuring Sustainable Development (note that Canada and the United States do not have an official SD indicator set).

[26] This inventory of SDI sets is also based on previous overviews (Hass and Moe, 2006; Kulig et al., 2010; Eurostat, 2010, WGSSD, 2009, Van der Kerk, 2010; GAO, 2010).

Table 8. Commonalities indicators sets of TFSD-institutes and countries

		Sustainable Development									Progress					Wellbeing		
Themes	Nationaal/I nternationaal	United Nations	Eurostat	World Bank	France	Germany	New Zealand	Norway	Switzerland	United Kingdom	United Nations	Eurostat	OECD	Australia	France-German report	Eurostat	OECD	% of SDI sets with this theme
Subjective wellbeing	N								X	X						X	X	22%
Consumption and income	N	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	89%
	I	X	X		X	X		X	X	X	X			X				78%
Health	N	X	X		X	X	X	X	X	X	X		X	X	X	X	X	100%
Housing	N	X					X		X	X	X			X			X	44%
Education	N	X	X		X	X	X	X	X	X	X	X		X	X	X	X	100%
Leisure	N													X			X	0%
Inequality	N	X	X		X	X	X		X	X	X		X	X	X			78%
Physical safety	N	X				X	X		X	X			X	X		X	X	56%
Trust	N				X				X	X			X	X	X	X	X	44%
Shared norms and values	N						X	X	X				X	X				33%
Institutions	N	X	X		X		X		X	X			X	X	X	X	X	78%
	I								X									11%
Energy reserves	N	X	X		X	X	X	X	X	X		X		X				100%
	I		X				X		X									44%
Non-energy reserves	N	X	X		X	X	X		X	X			X	X	X			78%

	I								X									11%
Land and ecosystems	N	X	X		X	X	X	X	X	X	X		X	X	X			100%
	I								X									22%
Water	N	X	X		X		X	X	X	X	X		X	X				89%
	I																	0%
Air quality	N	X	X		X	X	X		X	X			X			X	X	89%
Climate	N	X	X		X	X	X	X	X	X	X	X	X	X	X			100%
	I				X													22%
Labour	N	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	100%
	I																	0%
Physical capital	N	X	X			X	X		X	X	X		X	X	X			78%
	I																	0%
Knowledge capital	N	X	X		X	X	X		X			X	X		X			78%
	I																	0%
Financial assets	N	X	X			X	X			X				X				56%
Financial stability	N		X		X		X	X	X						X			56%
Monetized aggregates	N			X										X				11%

N – National ("Here and now" and "Later"), I – International ("Elsewhere")

Sources Sustainable Development: United Nations - Commission on Sustainable Development (United Nations, 2007); Eurostat (2009); World Bank (2011); France (ICSD, 2010); Germany (FSOG, 2010); New Zealand (Statistics New Zealand, 2009); Norway; Switzerland (FSOS, 2009), United Kingdom (DEFRA,2010).

*Sources Progress: United Nations – Millennium Development goals, Eurostat -Europe 2020 Strategy, OECD (Giovannini et al , 2009); Australia (ABS, 2010), French German report (*GCEE/CAE, 2010)

Sources Wellbeing: Eurostat Wellbeing report, OECD ("How life?")

In the table the indicators have been clustered according to themes but a distinction has been between the national and international dimensions as well as contextual indicators about population. Also there are a few categories that do not fall into the theme that were specified.

The last column in the table shows what percentage of SDI sets includes a certain theme. For example, two of the nine[27] (22%) indicator sets include indicator(s) about "subjective wellbeing".

The analysis of the contents of the main important datasets gives a number of interesting results:

- There are certain themes that are universal for *all* SDI sets (labour, health and nutrition, education, climate and land & ecosystems).
- There are certain themes that are very uncommon (subjective wellbeing, housing) or even non-existent (leisure) in the current generation of SDI sets.
- The use of monetary aggregates is very uncommon.
- Indicators about the international dimension in SDI sets are absent or strongly underrepresented in the majority of cases. However, "income" measures (such as ODA) are more common.

6. Sustainable Development Indicators

6.1 Indicator typology

Section 4 concentrated on the conceptual and theoretical aspects of measuring sustainable development, using a model in which the causalities between the here and now, later and elsewhere were made explicit. Section 5 derived a classification scheme with which to measure each the three dimensions of sustainable development. Also, it was shown that the SDI set can be organized in two ways: a conceptual and a thematic categorisation.

[27] The World Bank (2011) has been excluded because it is a monetary capital approach. Of course, the Wellbeing publications by Eurostat and the How's life? (OECD) also have subjective wellbeing indicators but we have only taken percentages of the indicator sets that deal directly with sustainable development.

In this section a long list and short list of indicators are selected based on the previous two sections, the SDI set of other institutes, and the availability of data in international databases.

However, before the long and short lists are presented, an "indicator typology" is discussed. The discussion of the causalities, as summarized by Figures 2 and 3, shows that the relationship between the 'here and now', 'later' and 'elsewhere' are complex. It is also clear that indicators can be used for different conceptual aspects. For example, for capital measurement there are indicators that measure the stock *levels* while there are also *flow* indicators such as investments and depreciation or extraction which measure the additions or reductions in the capital stocks respectively. Other types of indicators are *ratio* indicators which provide information about the productivity or intensity of use of certain capital stocks. It is possible to allocate many of the indicators of the SDI set according to these conceptual categories.

In this section the following indicator typology is used[28]**:**

- *Headline*. These indicators represent the main target indicators when it comes to the themes that have been identified. In the case of capital measures it must be an indicator of the *stock level* and in the case of human wellbeing the indicator must have a direct impact on the "here and now" dimension.
- *Investment (flow)* These are only used for capital themes when the indicator shows a level of investment in a capital stock.
- *Depreciation/Extraction (flow)* These are only used for capital themes when the indicator shows a reduction of a capital stock
- *Productivity (ratio).* Here the efficiency of use of the capital input is expressed as a ratio of monetary output per unit of input.
- *Intensity (ratio)*. This is the reciprocal of the productivity to show how much capital input is required per unit of output.
- *Other.* All other indicators.

[28] Note that this typology can be expanded to include more detailed categories. For example the SNA and SEEA also distinguish "discoveries" (for example, when new oil reserves are found) or "revaluations" (for example, when oil prices fluctuate). These are detailed categories that are important for certain capital stocks. The typology presented is classified on a much broader basis, so that it can apply to a broad range of themes.

It is important to realize the term *headline* may be used differently by the SDI sets that are currently available. In the above typology, the term is conceptually driven. For example, in the case of the capital measurement, the stock indicators are have to be the headline indicators. The flow and ratio indicators provide interesting additional information for policy makers and provide important information to influence the capital stocks. However, they cannot be classified as headline indicators. Similarly, the human wellbeing headline indicators are the those variables that influence human wellbeing. For example, the educational attainment or the level of pollution could be good headline indicator for human wellbeing, because they affect people's quality of life. The number of early school leavers is a good sub-indicator for policy makers, in order to try to influence the aggregate level of education, but it is not a headline indicator, in a conceptual sense.[29]

6.2 SDI long list: a selection

Section 5 has established which themes are relevant in the measurement of sustainable development. In this section a long list of indicators is chosen for each theme.[30]

The first step in the selection is to know what indicators are, from a conceptual point of view, required. It is important to be aware of what an "ideal" indicator shoul measure, because in many cases the practical set of indicators will include second-best choices because of data availability problems and/or methodological difficulties. In appendix 2, a description of the ideal indicators, per theme, is provided..

When selecting the practical set of indicators three aspects play a part:

[29] This terminology is at odds with many of the SDI sets that currently exist. Indicators such as greenhouse gas emissions, share of renewable energy, R&D investments or the number of school leavers are often considered to be "headline indicators" because they are the most important indicators in the policy area they describe. It seems to be a matter of semantics. The word "headline indicator" in policy circles is deemed to be the *most important or prevalent* indicator, while in this chapter a "headline" is related to the conceptual "target" indicator. It is therefore important to realize that the use of the term "headline" in the remainder of this chapter is conceptually driven. It is *not* an indication of the importance of an indicator.

[30] Note that the long and short list presented in this paper is *not* the official TFSD indicator set. The final report of the TFSD will be presented in june of 2012. Deliberations about the indicators list are still underway.

- *Conceptual considerations*. First and foremost, the requirements of the conceptual measurement system have priority.
- *International SDI sets*. It is revealing to see the choices that other countries or international organisation have made in the selection of indicators.
- *International databases.* The final criteria that may be of interest in the selection of SDI's is whether there are data available in international datasets such as those of the United Nations, OECD and Eurostat as well as other institutes.

The insights about the conceptual ideal indicators are provided in appendix 2, while annex 3 includes information about the international SDI set and international data availability. The resulting long list will be discussed in section 6.3.

Note that the analysis in Appendix 3 is preliminary. This inventory will be completed by the Task Force for Measuring Sustainable Development (TFSD) and will be presented in their final report (due June 2012). The TFSD will expand the number of SDI sets which to non-TFSD countries as well. Also the data availability will be analysed in greater detail. Nevertheless, the expansion of this exercise is not expected to alter the long list significantly.

6.3 SDI long list: Conceptual and thematic categorisation

The difference in the thematic and conceptual classification is explained in section 5.5. In this section, the long list of indicators are provided in both categorisations.

Table 9 shows the conceptual categorisation. Note that only "headline" indicators are provided since this is a good categorisation to represent the "state of the nation" in terms of sustainable development. Table 10 shows the thematic classification, which lends itself to the use of sub indicators (headline, investments, depletion, productivity, intensity and other- see section 6.1 for a description of the typology).

In both tables, the availability of this data in international databases is recorded in the last column. The two tables have a number of "place holders". These are indicators that are not available in international databases or for which statistical methods do not exist currently, but which should be included in an SDI set from a conceptual point of view.

Table 9. SDI long list - Conceptual categorisation

Classification	Sub-classification	Theme	Indicator	International database
Human wellbeing	Overarching indicators	HWB-H1-Wellbeing	Life satisfaction	EB, WHD
		HWB-H2-Consumption&income	Household consumption expenditures	ESTAT, OECD
	Personal needs	HWB1. Health	Life expectancy	ESTAT, OECD
		HWB2. Housing	Living without housing deprivation	ESTAT
		HWB3. Air quality	Urban exposure to particulate matter	ESTAT
		HWB4. Education	Educational attainment	ESTAT, OECD
		HWB5. Leisure	Time spent on recreation	MTUS
		HWB6. Labour	Unemployment rate	ESTAT
		HWB7. Inequality	Inequality	ESTAT, OECD
		HWB8. Physical safety	Victim of burglary/assault	ESTAT
	Social needs	HWB9. Trust	Generalised trust	ESS
			Bridging social capital	*Place holder*
		HWB10. Shared norms and values	*Shared norms and values*	*Place holder*
		HWB11. Institutions	Trust in institutions	Eurobarometer
Capital	Economic capital	EC1. Physical capital	Physical capital stock	EUKLEMS
		EC2. Knowledge capital	*Capital stock*	*Place holder*
	Financial capital	FC1. Financial assets	Assets minus liabilities	ESTAT
	Natural capital	NC1. Energy reserves	Fossil fuel reserves	BP
		NC2. Non-energy reserves	*Non-energy reserves*	*Place holder*
		NC3. Land and ecosystems	*Land assets*	*Place holder*
			Biodiversity index	*Place holder*
		NC4. Water	*Water quality index*	*Place holder*
		NC5. Air quality	Urban exposure to particulate matter	ESTAT
		NC6. Climate	Global CO_2 concentration	ESTAT
	Human capital	HC1. Labour	Participation rate	ESTAT, OECD
		HC2. Education	Educational attainment	ESTAT, OECD
		HC3. Health	Life expectancy	ESTAT, OECD
	Social capital	SC1. Trust	Generalised trust	ESS
			Bridging social capital	*Place holder*
		SC2. Shared norms and values	*Shared norms and values*	*Place holder*
		SC3. Institutions	Trust in institutions	Eurobarometer
	Monetary aggregates	EC-M. Economic capital	Economic capital	World Bank
		FC-M. Financial capital	Financial capital	World Bank
		NC-M. Natural capital	Natural capital	World Bank

		HC-M Human capital	Human capital	World Bank, OECD
		SC-M. Social capital	*Social capital*	*Place holder*
		EW-M. Economic wealth	Economic wealth	World Bank
International dimension	Consumption and income	INT1. Consumption&income	ODA	ESTAT
			Total trade with LDC's	ESTAT,OECD, UN
	Natural capital	INT2. Energy reserves	Import of energy resources	ESTAT,OECD, UN
			Energy dependence	ESTAT
		INT3. Non-energy reserves	Import of non-energy resources	ESTAT,OECD, UN
		INT4. Land and ecosystems	*Land footprint*	*Place holder*
		INT5. Water	*Water footprint*	*Place holder*
		INT6. Climate	*Carbon footprint*	*Place holder*
			Production based-emission	*Place holder*
			Climate trade balance	*Place holder*
	Human capital	INT7. Labour	*Brain drain*	*Place holder*
	Economic capital	INT8. Physical capital	Export of capital goods to LDC's	ESTAT,OECD, UN
		INT9. Knowledge capital	*Knowledge spillovers*	*Place holder*
	Social capital	INT10. Instituions	*International institutions*	*Place holder*

Table 10. SDI long list - Thematic categorisation

Theme	**National/ International**	**Indicator Type**	**Indicator**	**International database**
Wellbeing	N	HEAD	Life satisfaction	EB, WHD
Consumption & Income	N	HEAD	Household consumption	ESTAT, OECD
	N	OTHER	Gross Domestic Product (GDP)	ESTAT, OECD
	N	PROD	Labor productivity	ESTAT, OECD
	N	PROD	Multifactorproductivity	ESTAT, OECD
	I	HEAD	Official Development Assistance	ESTAT
	I	HEAD	Imports from LDC's	ESTAT, OECD
Health	N	HEAD	Life expectancy at birth	ESTAT, OECD
	N	OTHER	Healthy life expectancy at birth	ESTAT
	N	OTHER	Suicide death rate	ESTAT, OECD
	N	INV	Health expenditures	OECD
	N	DEPR	Smoking	ESTAT, OECD
	N	DEPR	Obesity	ESTAT, OECD
Housing	N	HEAD	Living without housing deprivation	ESTAT
	N	INV	*Investments in housing*	*Place holder*

	N	INV	*New houses*	*Place holder*
Education	N	HEAD	Educational attainment	ESTAT, OECD
	N	INV	Expenditures on education	ESTAT, OECD
	N	OTHER	Maths PISA-scores	OECD
	N	OTHER	Language PISA-scores	OECD
	N	OTHER	Educational attainment of young adults	ESTAT
	N	DEPR	Early school leavers	ESTAT
	N	OTHER	Life long learning	ESTAT, OECD
Leisure	N	HEAD	Time spent on recreation	MTUS
Inequality	N	HEAD	Income inequality	ESTAT, OECD
Physical safety	N	HEAD	Victim of burglary/assault	ESTAT
	N	INV	*Expenditures on safety*	*Place holder*
Trust	N	HEAD	Generalised trust	ESS
	N	HEAD	*Bridging social capital indicator*	*Place holder*
	N	OTHER	Satisfaction with family life	ESS
	N	INV	Interact with friends and family	ESS
	N	INV	Time spent with friends, family, volunteering	MTUS
Institutions	N	HEAD	Trust in institutions	ESTAT, OECD
Energy reserves	N	HEAD	Fossil fuel reserves	BP
	N	DEPR	Extraction	BP
	N	INT	Energy intensity	ESTAT, OECD
	N	OTHER	Renewable energy	ESTAT, OECD
	I	HEAD	Import of energy resources	ESTAT,OECD, UN
	I	HEAD	Energy dependence	ESTAT
Non-energy reserves	N	HEAD	*Resource reserves*	*Place holder*
	N	DEPR	*Extraction*	*Place holder*
	N	DEPR	Domestic Material Consumption	ESTAT
	N	DEPR	Municipal solid waste	ESTAT, OECD
	I	HEAD	Import of non-energy resources	ESTAT,OECD, UN
Land and ecosystems	N	HEAD	*Land assets*	*Place holder*
	N	OTHER	*Soil quality indicator*	*Place holder*
	N	DEPR	*Emissions to soil*	*Place holder*
	N	HEAD	*Biodiversity indicator*	*Place holder*
	N	DEPR	Red list	ESTAT
	I	HEAD	*Land footprint*	*Place holder*
Water	N	HEAD	*Fresh water resources*	*Place holder*
	N	DEPR	Surface and groundwater extraction	OECD

	N	HEAD	*Water quality indicator*	*Place holder*
	N	DEPR	*Emissions to water*	*Place holder*
	I	HEAD	*Water footprint*	*Place holder*
Air quality	N	HEAD	Urban exposure to particulate matter	ESTAT
	N	DEPR	Emissions of particulate matter	ESTAT, OECD
	N	OTHER	Urban exposure to ozone	ESTAT
	N	DEPR	Emissions of tropospheric ozone	ESTAT, OECD
	N	DEPR	Emission of acidifying emissions	ESTAT, OECD
Climate	G	HEAD	Global CO_2 concentration	ESTAT
	N	DEPR	*Historical CO2-emissions*	*Place holder*
	N	DEPR	GHG-Emissions	ESTAT, OECD
	N	INT	GHG-Emissions intensity	ESTAT, OECD
	I	HEAD	*Carbon footprint*	*Place holder*
	I	HEAD	*Climate trade balance*	*Place holder*
	G	OTHER	*State of the ozone layer*	*Place holder*
	N	DEPR	CFC emissions	ESTAT, OECD
Labour	N	HEAD	Participation rate	ESTAT, OECD
	N	OTHER	Unemployment rate	ESTAT, OECD
	N	OTHER	Hours worked	ESTAT, OECD
	N	DEPR	Average exit age labour market	ESTAT
	I	HEAD	*Brain drain*	*Place holder*
Physical Capital	N	HEAD	Physical capital stock	EUKLEMS
	N	INV	Gross capital formation	ESTAT, OECD
	I	HEAD	Export of physical capital	ESTAT, OECD, UN
Knowledge Capital	N	HEAD	*R&D capital stock*	*Place holder*
	N	INV	R&D expenditures	ESTAT, OECD
	I	HEAD	*Knowledge spillovers*	*Place holder*
Financial capital	N	HEAD	Assets minus liabilities	ESTAT, OECD
	N	OTHER	Public debt	ESTAT, OECD
	N	OTHER	Current deficit	ESTAT, OECD

G- Global, I – International, N - National

HEAD – Headline indicator, INV – Investment, DEPR – Depreciation, PROD – Productivity indicator, INT – Intensity indicator, OTHER – Other type of indicator

EB – Eurobarometer, ESS- European Social Survey, ESTAT – Eurostat, EUKLEMS – Productivity database (Eurostat), MTUS – Multinational Time Use Surveys, OECD – Organisation of Economic Cooperation and Development, United Nations – United Nations, WHD - World Happiness Database.

6.4 SDI short list

The long list provides a very broad range of indicators with which to measure sustainable development. However, for policy purposes or to communicate these indicators to the general public, it is useful to have a small set.

A small set is particularly important for communication purposes. How large should this small set be? The TFSD put out a questionnaire in which it asked over 50 countries about this issue. Many countries indicate that 5-15 indicators would be appropriate for a small set. However, from our analysis of the SDI sets of other institutes (appendix 3) the number of headline indicators is higher (15-20).[31]

The question therefore arises how to arrive at a small set of indicators. There are a number of options available

- *Composite Indicators/Monetisation*. Of course, aggregating the various indicators through monetization or other methods of aggregation is the only option to reduce the number of indicators to one[32]. However, as has been discussed in section three, Statistics Netherlands is cautious about such approaches.
- *Correlation analysis*. Some indicators may be heavily correlated, and therefore make one or the other redundant. However, this may vary per country and can only be said about past trend. It is also unlikely that this will lead to very large reductions.
- *Visualisation.* Instead of reducing the number of indicators, it is also possible to produce information reduction by visualisation techniques. In the Sustainability Monitor for the Netherlands (CBS/CPB/PBL/SCP, 2011) this approach was adopted. Colours were assigned to each indicator and also used to shape the website (www.cbs.nl/duurzaamheid).[33]
- *International SDI sets/International databases*. Finally, one could chose one indicators on the basis of how common they are in SDI sets around the world or

[31] When it comes to the total indicators sets (headline and sub-indicators) very few countries seem to be restrictive in the number of indicators. Each country, in addition to the headline indicators uses a larger set of indicators for more in depth monitoring or sustainable development. The number of indicators sometimes exceed over 100.

[32] If one wants to keep the "here and now", "later" and "elsewhere" distinction, three composites would be needed.

[33] Other countries also use visualisation techniques to communicate their SDI sets (e.g Switzerland).

on the data availability. The drawback is that the conceptual considerations will be less important, or that areas in which measurement is not as advanced (notably social issues) are underrepresented.

Table 11. SDI short list– Thematic categorisation

Theme	**Global/ National/ International**	**Indicator Type**	**Indicator**	**International database**
Wellbeing	N	HEAD	Life satisfaction	EB, WHD
Consumption & Income	N	HEAD	Household consumption expenditures	ESTAT, OECD
	I	HEAD	Official Development Assistance	ESTAT, OECD
	I	HEAD	Total trade with LDC's	ESTAT, OECD, UN
Health	N	HEAD	Life expectancy	ESTAT
Housing	N	HEAD	Living without housing deprivation	ESTAT
Education	N	HEAD	Educational attainment	ESTAT, OECD
Leisure	N	HEAD	Time spent on recreation	MTUS
Inequality	N	HEAD	Inequality	ESTAT
Physical safety	N	HEAD	Victim of burglary/assault	ESTAT
Trust	N	HEAD	Generalised trust	ESS
Shared norms and values	N	HEAD	*Shared norms and values*	*Place holder*
Institutions	N	HEAD	Trust in institutions	ESTAT
Energy reserves	N	HEAD	Energy reserves	BP
	N	DEPR	Energy Consumption	ESTAT, OECD
	N	OTHER	Renewable energy	ESTAT, OECD
	I	HEAD	Import of energy resources	ESTAT, OECD, UN
Non-Energy reserves	N	DEPR	Domestic Material Consumption	ESTAT
	I	HEAD	Import of non-energy resources	ESTAT, OECD, UN
Land and ecosystems	N	HEAD	*Biodiversity indicator*	*Place holder*
	I	HEAD	*Land footprint*	*Place holder*
Water	I	HEAD	*Water footprint*	*Place holder*
Air quality	N	HEAD	Urban exposure to particulate matter	ESTAT
Climate	G	HEAD	CO_2 concentration	ESTAT
	N	DEPR	GHG-Emissions	ESTAT
	I	HEAD	*Carbon footprint*	*Place holder*
Labour	N	HEAD	Participation rate	ESTAT, OECD
Physical Capital	N	INV	Gross capital formation	ESTAT, OECD
Knowledge Capital	N	INV	R&D expenditures	ESTAT, OECD
Financial capital	N	HEAD	Assets minus liabilities	ESTAT, OECD

G- Global, I – International, N - National

HEAD – Headline indicator, INV – Investment, DEPR – Depreciation, PROD – Productivity indicator, INT – Intensity indicator, OTHER – Other type of indicator

EB – Eurobarometer, ESS- European Social Survey, ESTAT – Eurostat, EUKLEMS – Productivity database (Eurostat), MTUS – Multinational Time Use Surveys, OECD – Organisation of Economic Cooperation and Development, United Nations – United Nations, WHD - World Happiness Database.

In table 11 a small set of indicators is derived using the latter strategy. According to the level of adoption the long list has been reduced to 30. This is still quite a large set but further reduction starts to become quite difficult. Note that not all 30 of these indicators may be relevant to all countries. For example, for countries without energy reserves, this indicator is not necessary. Note also that the set of indicators is very much defined for the developed countries.

There are five "place holders" in table 11. Despite the fact that these are not yet available, they seem crucial in the measurement of sustainable development. They relate to the measurement of shared norms and values, biodiversity[34] and footprint indicators[35].

7. Conclusions

This paper describes the way in which Statistics Netherlands quantifies the multidimensional concepts of sustainable development, human wellbeing and societal progress. It is shown that the measurement of 'Beyond GDP'-issues has a long history. Especially after the publication of the Brundtland Report in the late 1980s the number of measurement systems has grown considerably.

However, the many different initiatives to measure sustainable development vary a great deal. The various datasets that have been published over time by statistical bureaus and international organisations still show a high degree of diversity. There are, however, promising signs of a convergence between the various statistical

[34] The measurement of biodiversity or ecosystems, and in particular its monetisation, is a topic that has attracted academic attention lately (Kumar, 2011). Also the System of Environmental and Economic Accounts will also produce a publication ("Volume 2") on this topic.

[35] As was already discussed in the sections on the international dimension there are now efforts to harmonize the methodologies of the footprint indicators.

initiatives in the field of measuring sustainable development. The first part of the paper (the sections two and three) which deals with the history of the measurement of SD shows that the first important steps towards harmonisation are taken, even though there is still a lot of work to be done in this field.
This convergence concentrates on the following points, as most statistical institutes now aim at the development of a set of indicators, rather than one composite indicator. Furthermore, most bureaus follow the integrated approach which focuses on current as well as future wellbeing. Besides, most institutes are cautious when it comes to monetise a wide range of sustainability themes. Last but not least, there is a growing tendency to base SDI sets on a conceptual basis in which capital theory plays an important role.

In 2007 Statistics Netherlands started to do work on the measurement of SD. This paper has described the conceptual approach which has been adopted. It is based on the above principles of convergence and on the following areas core areas in the literature, i.e.:

- The Brundtland report,
- The broad notion of welfare (in Dutch: brede welvaartbegrip),
- The Stiglitz-Sen-Fitoussi Report, with its focus on economic theory,
- A broad range of other socials science literature (such as happiness literature and the social production function approach)

The last sections of the paper deal with the identification of the main sustainable development themes which should be included in an SDI set. This classification scheme is based on a wide range of academic literature and statistical handbooks. Finally, on the basis of this conceptual work as well as a thorough empirical investigation into the availability of relevant indicators, a long list of sustainable development indicators is presented. As this long list may contain too much information to convey to a larger audience properly, also a 'shortlist' of the main SD indicators is presented.

8. Future directions

There are countless directions that the measurement of sustainable development may take. This section includes a brief summary of the directions that the measurement will follow at Statistics Netherlands.

- *International harmonization*. Statistics Netherlands will play its part in the international discussion that contribute to harmonization of the measurement of sustainable development an progress. Work will focus on the Sponsorship Group for Sponsorship group on measuring progress, well-being and sustainable development, the Task force for Measuring Sustainable Development (TFSD) and the E-Frame consortium (see box 1 for details).
- *Sustainability Monitor of the Netherlands*. Statistics Netherlands will continue to update the indicator set that was published in the 2011 edition of the Monitor. The website www.cbs.nl/duurzaamheid/ will also be upgraded.
- *Sustainable development at different scales*. The conceptual model that has been presented in this paper measures sustainable development at the national level. Statistics Netherlands has a couple of programmes to investigate whether the TFSD indicator set can be used to create indicator systems at other levels of aggregation. For example, the indicators may be broken down into household types or industries using a satellite accounting system. Furthermore, the link between the indicator set for the TFSD and Corporate Social Responsibility (CSR, in Dutch Maatschappelijk Verantwoord Ondernemen) will be analysed to see how much overlap there is36
- *Statistical expansions*. Statistics Netherlands will also expand statistics in the following directions:
  - *Footprint indicators*. The work on the carbon footprint will be expanded and the possibilities of a land and material footprint will be investigated. These indicators will help society to further understand the international dimension of sustainable development i.e. the shifting of environmental burdens between countries.
  - *Historical statistics*. Since sustainable development is very much a long term issue, long time series of many of the indicators will be created. This will allow for analysis of the sources of our current sustainability problems.
  - *Subjective wellbeing*. Statistics Netherlands will also expand the set of indicators that are available for subjective wellbeing. These statistics will help society to understand the perception of people in their own wellbeing.

[36] An example of a very elaborate CSR system is the Global reporting Initiative (GRI). See www.globalreporting.org

Appendix 1. The Sustainability Monitor for the Netherlands (2011)

The dashboards as presented in the Dutch Sustainability Monitor have a lot in common with the conceptual work presented in this paper. Nevertheless, there are also a number of minor differences in the conceptual model, classification scheme and indicator sets.

The conceptual framework that has been presented in this paper is based on our work in the Task Force for Measuring Sustainable Development (TFSD). Partners include the United Nations, OECD, Eurostat, European Commission, the World Bank and the top countries in the area of measuring sustainable development. Our partners in the Sustainability Monitor are the CPB, PBL and SCP which are well respected policy institutes of the Dutch government.

As one might imagine there are conceptual differences between each of these institutes. There are also differences in the international and national debates over sustainable. It is therefore not surprising that subtle differences will emerge in the outcomes of our national and international 'negotiations'. In the remainder of this appendix these differences will be elaborated briefly.

The Sustainability Monitor uses *both* the conceptual and thematic SDI sets and as such is the first SDI publication in the world to do so. Other countries have either adopted one or the other. The themes and indicators of the sub-indicators differ somewhat. Particularly the indicators vary in quite a few places because in the national setting a greater amount of data is available.

Table A.1 shows the conceptual categorisation of the Sustainability Monitor. Below the differences with the TFSD are explained.

Table A.1. Conceptual categorisation of the Sustainability Monitor for the Netherlands

Quality of life		
Theme	**Sub theme**	**Indicator**
Well-being and material welfare	Well-being	Satisfaction with life (2008)
	Material welfare	Consumption of households (2010)
Personal characteristics	Health	Perceived health (2009)
		Healthy life expectancy (2008)
	Housing	Satisfaction with housing (2004)
		Quality of housing (2009)
	Education	Satisfaction with own education (2007)
		Education level (2009)
	Leisure time	Satisfaction with leisure time (2007)
		Leisure time
	Mobility	Traffic-jams are a personal problem
		Commuting time (2003)
	Social security	Satisfaction with own financial situation (2010)
		Long-term unemployment (2010)
	Pensions	Pension reserves (2008)
Living conditions	Physical safety	Not feeling safe (2008)
		Reported crime (2008)
	Inequality	Satisfaction with income inequality (2008)
		Income inequality (2009)
		Income inequality men/women (2009)
	Social participation and trust	Generalised trust (2008)
		Feelings of discrimination (2008)
		Contact with friends/family (2008)
		Volunteer work (2008)
	Institutions	Trust in institutions (2008)
		Voter turnout (recent)
	Natural environment	Satisfaction with green areas (2007)
		Nature reserves (2009)
	Air quality	Urban exposure to particulate matter (2008)
Resources		

Theme	Sub theme	Indicator
Natural Capital	Land	Population density (2008)
	Natural environment	Biodiversity
	Climate	Historic CO_2 emissions (2007)
	Energy	Energy reserves (2009)
	Soil quality	Phosphorus surplus soil (2003)
	Water quality	Quality of surface water (2007)
	Air quality	Urban exposure to particulate matter (2008)
Human Capital	Labour	Labour force (2010)
		Hours worked (2010)
	Health	Healthy life expectancy (2008)
	Education	Educational level (2009)
Social Capital	Social participation and trust	Generalised trust (2008)
		Feelings of discrimination (2008)
	Institutions	Trust in institutions (2008)
Economic Capital	Physical capital	Capital stock
	Knowledge	R&D Capital stock
	Debt	Net financial position NL vs. other countries (2009)
International dimension		
Theme	**Sub theme**	**Indicator**
Environment and raw materials	Energy	Imports of energy (2008)
	Raw materials	Imports of minerals (2008)
		Imports of biomass (2008)
	Climate	Emission trade balance
Trade and aid	Aid	Development aid (2009)
		Remittances (2009)
	Trade	Total imports from LDCs (2009)
		Imports of energy from LDCs (2008)
		Imports of minerals from LDCs (2008)
		Imports of biomass from LDCs (2008)

Quality of Life

In the Dutch Sustainability Monitor dashboard 1 is labelled as 'Quality of Life', whereas in the TFSD the somewhat broader term of 'Human Wellbeing' is used. The different themes of dashboard 1 closely follow our international work. First of

all a distinction is made between personal and social needs (or the slightly different labels in the Dutch context: personal characteristics and living conditions).

Also here, the first dashboard opens with the two overarching indicators on life satisfaction and consumption. Some of the themes that we include in our international work under personal characteristics are headed under 'living conditions' in the Dutch monitor. This can partly be explained because instead of social characteristics, the Dutch monitor uses a broader concept of living conditions, also including environmental aspects.

In the Dutch monitor also the theme *mobility* (measured in terms with traffic jams and commuting time) is included, and due attention is paid to long-run risks and security (which can be seen as important determinants of our present human wellbeing). A striking feature of the Dutch Sustainability dashboard is the attempt to include subjective (perception) indicators and objective indicators for each theme. For example, dashboard 1 does not only chart the actual health and educational status, but also indicates how satisfied people are with their health and educational attainments. In the category living conditions, the natural environment is included with two indicators (this category is not included in our international work due to data limitations).

Capital

This dashboard closely follows our international work and included the same capital types (economic, human, natural and social capital). For natural capital the non-energy reserves are not included, simply because this category is not very relevant in the Dutch context. Besides, land and the natural environment (biodiversity) are treated as separate categories in the Dutch sustainability monitor, whereas they are combined in our international work.

International dimension

The measurement of the international aspects of sustainable development is still in its infancy. It is also for that reason that, even though in principle the Dutch work largely corresponds with the international work, there are some differences in categorisation. The international work makes a conceptual distinction of different flows between countries (consumption&income, natural-, human, physical- and social capital). However, in our international project for a lot of these themes indicators are not (yet) available. Therefore, in the Dutch monitor a simpler version

of this dashboard is presented. The natural dimension of 'natural capital' is measured in terms of the imports and exports of energy and raw materials, whereas climate is measured on the basis of an emission trade balance. These themes and indicators are in line with the international recommendations.

The other, non-ecological, aspects are included in the theme 'trade and aid'. This part of the dashboard focuses on the trade relations with the least developed countries, as the disparities of development between the west and 'the rest' are strongly emphasised in the Brundtland Report. As far as trade is concerned, the positive as well as potentially harmful aspects of trade with the LDC's are mentioned. The total imports in the Netherlands from the LDC's capture the positive elements of the gains from trade for the LDC's. The specific imports of energy, minerals and biomass are an indication of the extent to which the Netherlands contributes to the depletion of natural capital in the LDC's. Under the sub-theme 'aid', developmental aid and remittances are included.

Table A.2 shows the thematic categorisation of the Sustainability Monitor. The sub-indicators are quite different, but the choices here are all mainly driven by data availably issues.

Table A.2. Conceptual categorisation of the Sustainability Monitor for the Netherlands

Well-being	
Sub theme	**Indicator (recent year)**
Well-being	Satisfaction with life (2008)
Health	Perceived health (2009)
Housing	Satisfaction with housing (2004)
Education	Satisfaction with own education (2007)
Leisure time	Satisfaction with leisure time (2007)
Financial security	Satisfaction with own financial situation (2010)
Safety	Not feeling safe (2008)
Inequality	Satisfaction with income inequality (2008)
Institutions	Trust in institutions (2008)
Nature	Satisfaction with green areas (2007)
Climate and energy	
Climate (international)	Historic CO_2 emissions (2007)
	Emission trade balance
	Total greenhouse gas emissions per capita (2008)
	Greenhouse gas intensity of energy use (2008)
	CO_2 emissions (2007)
	Greenhouse gas intensity of the economy (2008)
Energy	Energy reserves (2009)
	Renewable energy (2008)

	Depletion of energy reserves
	Gross domestic energy use (2009)
	Energy intensity of the economy (2009)
Energy (international)	Imports of energy (2008)
Quality of local environment	
Soil	Phosphorus surplus soil (2003)
	Nitrogen surplus in soil (2003)
Water	Quality of surface water (2007)
	Water collection from surface and ground water (2007)
Air	Urban exposure to particulate matter (2008)
	Exposure to ozone in urban areas (2008)
	Emissions of acidifiers (2006)
Biodiversity and landscape	
Land	Population density (2008)
	Land use as a result of consumption
Nature / biodiversity	Satisfaction with green areas (2007)
	Nature reserves (2009)
	State of preservation (2006)
	Population Red List species
	Population not Red List species
	Farmland Bird Index (2005)
Health	
Health	Perceived health (2009)
	Healthy life expectancy (2008)
	Healthy life expectancy, men (2009)
	Life expectancy, men (2009)
	Life expectancy, women (2009)
	Mental health (2002)
	Health care expenditure (2009)
	Obesity (2004)
	Smoking (2004)
Housing and residential environment	
Housing and residential environment	Satisfaction with housing (2004)
	Quality of housing (2009)
	Problems in the neighbourhood (2009)
	Not enough space (2009)
	Average house price
	Average monthly rent
	Total share of housing costs (tenants and owner-occupiers) (2009)
	Perceived housing costs (2009)
	Number of available dwellings
Mobility	
Mobility	Traffic-jams are a personal problem
	Commuting time
	Mobility (general)
	Car ownership (2009)
	Time lost because of traffic jams and delays
	Noise nuisance from traffic (road, rail, air)
	Bicycle ownership
	Car use (2008)
	Train use (2008)
	Traffic deaths (2008)

	Rail infrastructure (2009)
Safety	
Safety	Not feeling safe (2008)
	Reported crime (2008)
	Registered crime
	Registered murders (2008)
	Underage suspects (2006)
	Number of prisoners (2008)
	Security expenditure (2009)
	Number of police officers (2008)
	Trust in the police (2008)
	Trust in the justice system (2008)
	Fear of terrorist attacks (2008)
Social participation and trust	
Social participation and trust	Contact with friends/family (2008)
	Volunteer work (2008)
	Satisfaction with family life (2007)
	Satisfaction with residential environment (2004)
Leisure time	Satisfaction with leisure time (2007)
	Leisure time
Trust	Feelings of discrimination (2008)
	Generalised trust (2008)
	Opinions about immigrants (2008)
Institutions	Trust in institutions (2008)
	Voter turnout (recent)
Education and knowledge	
Education	Satisfaction with own education (2007)
	Education level (2010)
	People with high education level (2010)
	Education level of young people (2009)
	Early school-leavers (2009)
	Maths skills (2009)
	Lifelong learning (2009)
	Education expenditure (2007)
Knowledge	R&D Capital stock
	R&D expenditure (2009)
	Number of researchers (2007)
	Scientific articles (2007)
	Patents (2008)
	Knowledge networks (2008)
Material welfare and economy	
Material welfare	Consumption of households (2010)
	Gross Domestic Product (2010)
	Labour productivity (2009)
Labour	Labour force (2010)
	Hours worked (2010)
	Retirement age (2009)
	Labour participation rate (2010)
	Unemployment rate (2010)
Physical capital	Capital stock
	Investment
	ICT expenditure (2009)
Financial security	Satisfaction with own financial situation (2010)

	Long-term unemployment (2009)
Financial sustainability	
Financial sustainability	Net financial position NL vs. other countries (2009)
	Pension reserves (2008)
	Central government debt (2010)
Trade, aid and raw materials	
Aid	Development aid (2009)
	Remittances (2009)
Trade	Imports of minerals (2008)
	Imports of biomass (2008)
	Total imports from LDCs (2009)
	Imports of energy from LDCs (2008)
	Imports of minerals from LDCs (2008)
	Imports of biomass from LDCs (2008)
Inequality	
Inequality	Satisfaction with income inequality (2008)
	Income inequality (2009)
	Income inequality men/women (2009)

Appendix 2. Ideal Indicators

Subjective Wellbeing (all countries)

National headline indicators: Conceptually an overall measure of the subjective wellbeing of the population is required. At the moment the literature points to "life satisfaction" as the most appropriate indicator.

Consumption& income (all countries)

National headline indicators: This theme includes various macro-economic aggregates as well as the drivers of economic growth. The Stiglitz report (2009) emphasized the use of income and consumption measures and also to measure these from the perspective of the household.

Sub-indicators: Indicators for the drivers of economic growth, such as productivity and competitiveness, could be options.

International indicators: Here the direct income measures from the developed world to the developing countries can be used (e.g. Official Development Assistance (ODA) and remittances). The imports from LDC's could be viewed as an indicator of wealth creation in those counties.

Optional indicators: For many countries it is probably appropriate to have specific measures on poverty.

Health (all countries)

National headline indicators: The indicator should provide a summary value for the total physical and mental health of the population. Life expectancy is not a perfect measure of physical health but is very prevalent in SDI sets. Similarly, the suicide rate is often used in many countries as sort of proxy for mental wellbeing. Conceptually it might be fruitful to create indicators which take a "stock" perspective. This could be done by showing the number of years in good health that can be expected in future. For example, a number of indicators exist in the literature which tracks the "remaining healthy life years". This is also sometimes referred to as "years of healthy life remaining".

Sub-indicators: The level of health expenditures is an obvious conceptual sub-indicator, but there are many indicators. However, the commonalities analysis has

yielded a huge amount of additional indicators ranging from causes of death to medical facilities.

Optional indicators: Some country-specific lifestyle indicators (obesity, smoking, drinking and health lifestyle indicators) or problems of undernourishment are clearly also important driving forces for overall physical and mental health. Apart from the above sub-indicators one might also have some indicators which are specific for the health situation in specific countries. Examples include: the prevalence of physicians and hospital beds per person but also indicators that are related to major diseases such as HIV/AIDS and malaria.

Housing (all countries)

National headline indicators: Here, an overall volume measure of the quantity/quality of the dwellings that people live in is sought. Of course, the housing conditions are multifaceted and difficult to measure in a single measure. Indicators that measure certain aspects are living space (square meters per person) or the number of dwellings without deficiencies (leaking roofs etc.).

Sub-indicators: Sub-indicators include the investment in dwellings as well the building of new houses.

Optional indicators: In developing countries it is probably good to have indicators about people with inadequate housing (slum dwellers, homeless people).

Education (all countries)

National headline indicators: For the human wellbeing aspects of education the average level of competencies and education are sought. Happiness literature has shown that life satisfaction grows as these characteristics grow in the population. The level of skills and competencies goes beyond formal education but these indicators are regularly used. There are however also measures of competencies such as PISA scores (for the youth) as well as PIAAC scores (for whole population) (OECD).

Sub-indicators: As sub-indicators one might use the expenditures on education as well as indicators that threaten the overall educational level (e.g. early school leavers).

Optional indicators: In the developed world, access to education is more or less universal. This is not the case for the developing world where it would be good to measure enrolment rates at every level of education.

Leisure (all countries)

National headline indicators: Here a measure of the quantity and quality of leisure is required. In practice it is hard to measure the quality of leisure but it is possible to measure the time spent on leisure through time use surveys.

Inequality (all countries)

National headline indicators: There are many types of inequality in societies. There may be overall income inequality, inequality between genders, inequality in educational attainment etc. For each type there are proxy indicators such as the Gini coefficient available or indicators that compare the top and the bottom sections of a society.

Physical safety (all countries)

National headline indicators: Here one would want to measure the overall level of crime. However, the severity of the crimes may vary significantly and so it is conceptually problematic to come to a single indicator. Proxies include the amount of personal crimes or violent crimes that may be used.

Sub-indicators: Here one might want to measure expenditures or policing or the number of police staff.

Optional indicators: Some countries experience natural hazards, which is obviously also important for the physical safety.

Trust (all countries)

National headline indicators: Here the quality and quantity of social relationships should be measured (generalized trust), trust within subsections of society (family/neighbourhood) as well as the trust between groups in society (bridging social capital). In practice, these are very difficult concepts to measure. To measure overall trust, the indicators of generalised trust are often used (respondents are asked whether they trust other members of society that they do not know). There are also social survey questions that can be used for family and neighbourhoods. Finally, bridging social capital may be estimated by certain questions that indicate social exclusion (e.g. discrimination).

Sub-indicators: Here the investment perspective is important. The time spent on family, friends and volunteering may be measured.

Shared norms and values (all countries)

National headline indicators: Here one would want to measure the extent to which the members of the population share crucial norms and values. It is very difficult to measure an overall figure for this theme, although for some countries cultural aspects such as language could be relevant.

Institutions (all countries)

National headline indicators: This should be reflection of the quality of the institutions in society. This is of course very difficult because the institutions are very heterogeneous. There are however overall indicators in which the general public are asked to asses the quality of institutions in their country. Also the work of De Soto (ref) is very useful because it measures the time it takes to overcome bureaucratic procedures.

Optional indicators: In the case of some countries it may be good to add indicators for the level of corruption.

Energy reserves (some countries)

National headline indicators: Here the total physical and monetary stock of energy reserves is in question. The valuation of these reserves is covered by the SEEA-2012.

Sub-indicators: The extraction and discoveries are important sub-indicators. Also the energy use, energy intensity and share of renewables are very relevant.

International indicators: For the international dimension the direct imports from other countries (and specifically LDC's) can be used.

Non-energy reserves (some countries)

National headline indicators: Here the total physical and monetary stock of non-energy reserves are in question. The valuation of these reserves is covered by the SEEA-2012.

Sub-indicators: The extraction and discoveries are important sub-indicators. Also the material use, intensity and waste are very relevant.

International indicators: see energy reserves.

Land and ecosystems (all countries)

National headline indicators: Here the area and value of land are in question as well as the biodiversity/ecosystems. There is no consensus about an overall measure of

biodiversity but there are quite a few initiatives in the field of monetisation at present (Kumar, 2010). Measures for soil quality are also difficult to measure although it is possible to measure the quality of the soil in terms of the concentration of pollutants such as nitrates and phosphates in the soil.

Sub-indicators: Here the indicators on extinctions or threatened species as well as the land area for forest and nature may be used. The emissions to soil should be measured.

International indicators: An interesting aspect of land is that, through the consumption, countries are implicitly "using" land of other countries. This is also creates pressures on the biodiversity in those regions. The ecological footprint is also based on consumption and on land use but it also contains the fictive amount of forest that is required to compensate for CO_2 emissions. A "land footprint", without the hectares for CO_2 compensation, could also be calculated. A footprint is, in principle still "national" indicator but it could become an international indicator by simply talking the land use in foreign countries.

Optional indicators: For some countries, the issue of erosion may be very relevant.

Water (some countries)

National headline indicators: The overall quality of water is again very difficult but can be approached using the concentration of certain pollutants. Also the Biochemical Oxygen Demand (BOD) index is often used.

Sub-indicators: The emissions to water are relevant. The extraction and use of water would be appropriate sub-indicators.

International dimension: Here the "water footprint" could be calculated.

Optional indicators: The overall amount of (fresh) water is only relevant in countries where it a scare commodity. Specific information about the access to water is important since this is not a universal resource for all citizens in the developing world.

International indicators: Similarly to the land footprint there is also literature on the water footprint.

Air quality (some countries)

National headline indicators: The overall air quality is difficult to measure but measuring certain pollutants that affect health provides a good proxy (Particulate matter, tropospheric ozone).

Sub-indicators: The emissions of these pollutants.

Optional indicators: In some countries smog may be a common phenomenon and should be measured.

Climate (all countries)

National headline indicators: Since this a global stock it should be measured by the CO_2 concentration or the global temperatures. Also the state of the ozone layer would be a good indicator of another aspect of the climatic system. If one wants to assign a national responsibility to the reductions in these capital stocks one would need to see what the accumulated emissions are (see for example Botzen et al, 2008. For example, using the CDIAC database one could calculate the historical CO_2 emission of countries.

Sub-indicators: Here the emissions and intensity of greenhouse gas emissions (and ozone precursors) should be measured.

International indicators: Here the embodied carbon footprint of consumption (at least the part that is in foreign countries) and the ”carbon balance of trade” can be measured (see land).

Labour (all countries)

National headline indicators: The largest impact on human wellbeing is of course the fact that one has job or not. Therefore the participation rates, or unemployment, seem to be good indicator for this dimension.

Sub-indicators: Additional indicators on the labour market, such as hours worked, the average exit age from labour market, replacement rates may be useful here.

Optional indicators: For some countries the working conditions or child labour will also be relevant.

Physical capital (all countries)

National headline indicators: This capital stock should provide a summary value of the stock of machines, buildings and infrastructure. The methods do to this are summarized in the handbook on “Measuring Capital” (OECD)

Sub-indicators: Overall gross capital formation (investment) or specific investments (ICT) are common in some SDI sets.

Optional indicators: For developing countries it may be useful to measure some non-monetary aspects: length of paved roads, railways, number of mobile phones, internet connections

Knowledge capital (all countries)

National headline indicators: Here the total stock of knowledge should be measured. Although knowledge is far broader concept, the stock of R&D capital is often taken as a proxy. The conceptual aspects of measuring this capital type are currently being developed in the wake of the SNA revision.

Sub-indicators: R&D investments (split into public and private may be useful). Also other indicators for innovation or patents may be used.

Financial capital (some countries)

National headline indicators: Here the national totals of assets minus liabilities from the SNA may be used.

Sub-indicators: Changes in the net of assets and liabilities or public debt and deficits.

Monetary aggregates (optional)

National headline indicators: For these indicators the monetary values for economic capital, financial capital, human capital, natural capital and social capital are used. The methodology can be derived from handbooks (SNA, SEEA, Measuring capital (OECD)). However in some cases, natural and social capital, methods are problematic or non-existent respectively. The "Economic Wealth" aggregate is the sum of these capital stocks.

Sub-indicators: Investments in these capital stocks.

Appendix 3. Long list and short list selection

Themes	N/I	Sub-themes	International SDI sets	International databases	Long list	Short list
Subjective Wellbeing	**N**	**Life satisfaction**	Life satisfaction (CH, UK)	Life satisfaction (EB, WHD)	Life satisfaction	Life satisfaction
	N	**Other**		Happiness (WHD)		
Consumption and income	**N**	**Consumption**	Final consumption expenditure of households, by consumption purpose (ESTAT)	Household consumption expenditures (OECD, ESTAT)	Household consumption expenditures	Household consumption expenditures
	N		Real household consumption expenditure per person (NZ)			
	N		Real household consumption expenditure (NZ)			
	N	**Income**	Net national income (ESTAT, NO)	Net national income (OECD, ESTAT)		
	N		Net domestic income (FR)			
	N		Real gross national disposable income per person (NZ)			
	N		Household income (CH)			
	N	**Saving**	Gross saving (UN)			
	N		Adjusted net savings as percentage of gross national income (UN)			
	N		Household saving rate (ESTAT)			
	N		Non-petroleum saving (NO)			
	N	**GDP**	Gross domestic product (UN, ESTAT, FR, DE, UK)	Gross domestic product (OECD, ESTAT)	Gross domestic product	
	N	**Poverty/debt**	Population living below poverty line (UN, CH)			
	N		Proportion of population below $ 1 a day (UN)			
	N		Persons at risk of poverty (ESTAT)			
	N		Severely materially deprived persons (ESTAT, FR)			
	N		Poverty rate (FR)			
	N		Number of households heavily in debt (FR)			
	N		Population with low incomes (NZ)			
	N		Working poor (CH)			
	N	**Productivity**	Labour productivity (UN, ESTAT, NZ, CH)	Labour productivity (OECD, ESTAT)	Labour productivity	
	N		Output per worker (UK)			
	N		Unit labour costs (UN)	Multifactorproductivity (OECD, ESTAT)	Multifactorproductivity	
	N	**Competitiveness**	Real effective exchange rate (ESTAT)			
	N		Diversity of exports (NZ)			
	N	**Subjective**	Household satisfaction with material standard of living (NZ)			
	I	**ODA**	Official Development Assistance (UN, ESTAT, FR, DE, NO, CH, UK)	Official Development Assistance (OECD, ESTAT, UN)	Official Development Assistance	Official Development Assistance
	I		Untied official development assistance (ESTAT)			

	I		Bilateral official development assistance (ESTAT)			
	I		Total EU financing for developing countries (ESTAT)			
	I	**Attitude to ODA**	Attitude towards development assistance (CH)			
	I	**Remittances**	Remittances as percentage of GNI (UN, CH)			
	I	**Imports from LDCs**	Share of imports from developing countries and from LDCs (UN, ESTAT, DE, NO)	Imports from LDC's (OECD, ESTAT, UN)	Imports from LDC's	Imports from LDC's
	I	**Barriers**	Average tariff barriers imposed on exports from developing countries and LDCs (UN)			
	I		Aggregated measurement of support for agriculture (ESTAT)			
	I		Duty-free imports from developing countries (CH)			
	I	**Fair trade**	Fair trade (CH)			
	I	**FDI**	Foreign direct investment (FDI) net inflows and net outflows as percentage of GDP (UN)			
	I	**FDI from LDC's**	Foreign direct investment in developing countries (ESTAT, CH)			
Health	**N**	**Life expectancy**	Life expectancy at birth (UN, FR, NO)	Life expectancy at birth (OECD, ESTAT)	Life expectancy at birth	Life expectancy at birth
	N		Life expectancy at age 65 (ESTAT)			
	N	**Healthy life expectancy**	Health life expectancy at birth (UN, FR, NZ, CH, UK)	Healthy life expectancy at birth (ESTAT)	Healthy life expectancy at birth	
	N		Health life expectancy at age 65 (ESTAT)			
	N	**Self reported health**	Self reported unmet need for medical examination or treatment (ESTAT)			
	N	**Suicide rate**	Suicide death rate (UN, ESTAT, FR, NZ, CH, UK)	Suicide death rate (ESTAT)	Suicide death rate	
	N	**Mental health**	Prevalence of psychological distress (NZ)			
	N		Mental well-being (CH)			
	N	**Health expenditures**	Health expenditure (CH)	Health expenditure (OECD)	Health expenditure (OECD)	
	N		Expenditure on care for the elderly (ESTAT)			
	N	**Mortality/morbidity/incidence/survival rates**	Under-five mortality rate (UN)			
	N		Premature mortality (DE)			
	N		Death rates from circulatory disease, cancer, and suicides (UK)			
	N		Morbidity of major diseases such as HIV/AIDS, malaria, tuberculosis (UN)			
	N		People killed in road accidents (ESTAT)			
	N		Serious accidents at work (ESTAT, FR)			
	N		Death rate due to chronic diseases, by gender (ESTAT)			
	N		Occupational diseases (FR)			
	N		Number of people and children killed or seriously injured (UK)			
	N		Cancer-survival probabilities (NZ)			
	N	**Health care facilities**	Percent of population with access to primary health care facilities (UN)			
	N		Unmet healthcare needs (FR)			

	N		Avoidable hospital admissions (NZ)			
	N	**Nutrition/obesity**	Nutritional status of children (UN)			
	N		Consumption of certain foodstuffs per inhabitant (ESTAT)			
	N		Proportion of people consuming a healthy diet (UK)			
	N		Proportion of obese people (DE, CH, UK)			
	N	**Water/sanitation**	Population with drinking water supply meeting standards (NZ)			
	N		Proportion of population using an improved sanitation facility (UN)			
	N	**Obesity**	Proportion of population using an improved water source (UN)			
	N		Population connected to urban waste water treatment with at least secondary treatment (UN)	Smoking (OECD, ESTAT)	Smoking	
	N	**Smoking**	Prevalence of tobacco use (UN, DE, UK)	Obesity (OECD, ESTAT)	Obesity	
	N	**Lifestyle/exercise**	Prevalence of healthy lifestyles (NZ)			
	N		Health-relevant behaviour: physical exercise (CH)			
	N	**Other**	Contraceptive prevalence rate (UN)			
	N		Immunization against infectious childhood diseases (UN, NZ)			
	N		Household consumption of hazardous substances (NO)			
Housing	**N**	**Housing stock**	Dwelling stock (UK)			
	N	**Investments**			Investments in housing	
					New houses	
	N	**Quality of housing**	Proportion of urban population living in slums (UN)	Living without housing deprivation (ESTAT)	Living without housing deprivation	Living without housing deprivation
	N		Number of rough sleepers (UK)			
	N		Number of households in temporary accommodation (UK)			
	N		Vulnerable households in the private sector in homes below the decent homes standard (UK)			
	N	**Social sector hosing**	Social sector homes (UK)			
	N	**Housing density**	Average density of new housing (UK)			
	N	**Satisfaction**	Percentage of households satisfied with the quality of the places in which they live (UK)			
	N	**Affordability/Costs**	Housing affordability (NZ)			
	N	**Costs**	Housing costs (CH)			
	N	**Other**	Households and single person households (UK)			
Education	**N**	**Educational attainment**	Educational attainment level of adults (UN, NZ, NO)	Educational attainment (OECD, ESTAT)	Educational attainment	Educational attainment
	N	**Expenditures**	Public expenditure on education (ESTAT)	Public expenditure on education (OECD, ESTAT)	Public expenditure on education	
	N	**Computer skills**	Individuals' level of computer skills (ESTAT)			
	N		Individuals' level of internet skills (ESTAT)			
	N	**Maths skills**		Maths PISA-scores (OECD)	Maths PISA-scores	
	N	**Literacy**	Reading skills of 15-years-olds (CH)	Reading PISA-scores (OECD)	Reading PISA-scores	

	N		Adult literacy rate (UN)			
	N		Low reading literacy performance of pupils (ESTAT)			
	N		Reading difficulties for young people (FR)			
	N		Literacy skills (NZ)			
	N		25-year-old university graduates			
	N		Gross intake ratio to last grade of primary education (UN)			
	N	**Graduates/enrolment**	Net enrolment rate in primary education (UN)			
	N		Share of students starting a degree course (DE)			
	N		Participation in tertiary education (NZ, CH)			
	N		19 year-olds with Level 2 qualifications and above (UK)	Educational attainment of young adults (ESTAT)	Educational attainment of young adults	
	N	**Early school leavers/Youth education**	Proportion of higher diplomas among the 25-34 age group (FR)	Early school leavers (ESTAT)	Early school leavers	
	N		Early school-leavers (ESTAT, FR, DE, CH, UK)			
	N		Access to early childhood education (NZ)			
	N	**Life long learning**	Life long learning (UN, ESTAT, FR)	Life long learning (ESTAT)	Life long learning	
	N	**Other**	Barometer of knowledge by households of the notion of sustainable development (NZ)			
Leisure	**N**	**Time use**		Time spent on recreation (ESTAT, MTUS)	Time spent on recreation	Time spent on recreation
Inequality	**N**	**Income overall**	Income inequality (UN, ESTAT, FR, NZ,CH)	Income inequality (ESTAT)	Income inequality	Income inequality
	N	**Income (male/female)**	Gender pay gap (ESTAT,FR, DE, CH)			
	N	**Income (age)**	Children in relative low-income households (UK)			
	N		Pensioners in relative low-income households (UK)			
	N	**Income (household types)**	At-risk-of-poverty rate, by household type (ESTAT)			
	N	**Income (education level)**	At-risk-of-poverty rate, by highest level of education attained (ESTAT)			
	N	**Income (regional)**	Dispersion of regional GDP per inhabitant (ESTAT)			
	N	**Income (ethnicity)**	Pay equality by ethnicity (NZ)			
	N	**Energy (overall)**	Share of households without electricity or other modern energy services (UN)			
	N		Percentage of population using solid fuels for cooking (UN)			
	N	**Labour (overall)**	Persons living in households with very low work intensity (ESTAT)			
	N	**Labour (male/female)**	Share of women in wage employment in the non-agricultural sector (UN)			
	N		Employment rate, by gender (ESTAT)			
	N		Unemployment rate, by gender (ESTAT)			
	N		Professional position by gender (CH)			
	N	**Labour (age)**	Unemployment rate, by age group (ESTAT)			
	N		Population living in workless households (a) children (b) working age (UK)			
	N	**Labour (education level)**	Employment rate, by highest level of education attained			

			(ESTAT)			
	N	**Labour (regional)**	Dispersion of regional employment rates, by gender (ESTAT)			
	N	**Education (age)**	Persons with low educational attainment, by age group (ESTAT)			
	N	**Education (ethnicity)**	Foreign school leavers with a school leaving certificate (DE)			
	N		Early school leavers by citizenship (CH)			
	N	**Education (socio-economic)**	Reading skills of 15-years-olds by socio-economic background (CH)			
	N	**Health (age group)**	Suicide death rate, males by age group (ESTAT)			
	N		Suicide death rate, females by age group (ESTAT)			
	N	**Health (socio-economic)**	Infant mortality: differences between socio-economic groups (UK)			
	N	**Health (regional)**	Life expectancy: differences in average life expectancy between local authority areas (UK)			
	N	**Institutes (male/female)**	Participation of women in governing bodies (FR)			
	N		Representation of women in Parliament and local government (NZ)			
	N		Women in the national council (CH)			
Physical safety	N	**Crime**	Number of intentional homicides per 100,000 population (UN)	Victim of burglary/assault (ESTAT)	Victim of burglary/assault	Victim of burglary/assault
	N		Burglaries in homes (DE)			
	N		Rate of death from assault (NZ)			
	N		Violent crime (CH)			
	N		Crime survey and recorded crime for (a) vehicles (b) domestic burglary (c) robbery (UK)			
	N	**Expenditures**			Expenditures on safety	
	N	**Fear of crime**	Impact of fear of crime on quality of life (NZ)			
	N		Fear of crime: (a) car theft (b) burglary (c) physical attack (UK)			
	N	**Natural hazards**	Human and economic loss due to natural disasters (UN)			
	N		Percentage of population living in hazard prone areas (UN)			
Trust	N	**Generalised trust**		Generalised trust (ESTATS)	Generalised trust	Generalised trust
	N	**Bridging social capital**		Bridging social capital indicator (ESTATS)	Bridging social capital indicator	
	N	**Family**		Satisfaction with family life (ESTATS)	Satisfaction with family life	
	N	**Time use/frequency**		Interact with friends and family	Interact with friends and family	
	N	**Voluntary work**	Voluntary work (CH, UK)	Time spent with friends, family, volunteering (MTUS)	Time spent with friends, family, volunteering	
	N		Participation in associative life (FR)			
Shared norms and values	N	**Culture**	Own cultural activities (CH)			
	N		Participation in cultural activities (CH)			
	N	**Language**	Children attending Māori language immersion schools (NZ)			

	N		Local content on New Zealand television (NZ)			
	N		Regular use of a second national language (CH)			
	N	**Monuments**	Standards of maintenance of protected buildings (NO)			
	N		Number of historic places (NZ)			
Institutions	**N**	**Corruption**	Percentage of population having paid bribes (UN)			
	N	**Voter turnout**	Voter turnout in elections (ESTAT, FR, NZ)			
	N	**Trust**	Level of citizens´confidence in EU institutions (ESTAT)	Trust in institutions (OECD, ESTAT)	Trust in institutions	Trust in institutions
	N		Trust in government institutions (NZ)			
	N	**Other**	New infringement cases (ESTAT)			
	N		Transposition of Community law, by policy area (ESTAT)			
	N		E-government on-line availability (ESTAT)			
	N		E-government usage by individuals (ESTAT)			
	N		Public sector fiscal revenue rate			
	I	**Treaties**	Multilateral treaties (CH)			
Energy reserves	**N**	**Reserves**		Fossil fuel reserves (BP)	Fossil fuel reserves	Fossil fuel reserves
	N	**Extraction**		Extraction (BP)	Extraction	
	N	**Consumption**	Energy consumption (UN, FR, CH, UK, ESTAT)			Energy consumption
	N		Electricity consumption of households (ESTAT)			
	N		Energy consumption in the residential-service sector (FR)			
	N	**Expenditures**	Household expenditure on energy used in the home (NZ)			
	N	**Supply**	Primary energy supply (NZ, UK)			
	N	**Intensity/productivity**	Energy Intensity (FR, ESTAT, UN, NZ, NO, CH)	Energy intensity (OECD, ESTAT)	Energy intensity	
	N		Energy productivity (DE)			
	N	**Renewables**	Share of renewable energy (DE, UN, ESTAT, FR, CH)	Renewable energy (OECD, ESTAT)	Renewable energy	Renewable energy
	N		Share of renewable electricity (UK, ESTAT, NZ)			
	N	**Heat/Power**	Combined heat and power generation (ESTAT)			
	N	**Tax rate**	Implicit tax rate on energy (ESTAT)			
	I	**Imports**		Import of energy resources (OECD, ESTAT, UN)	Import of energy resources	Import of energy resources
	I	**Energy dependence**	Energy dependence (ESTAT, NZ, CH)		Energy dependence	
Non-energy reserves	**N**	**Reserves**			Resource reserves	
	N	**Extraction**			Extraction	
	N	**Consumption**	Domestic material consumption (UN, ESTAT, UK, FR)	Domestic Material Consumption (ESTAT)	Domestic Material Consumption	Domestic Material Consumption
	N		Total material requirement (CH)			
	N	**Intensity/productivity**	Material intensity of economy (CH, UN)			
	N		Resource productivity (ESTAT, FR, DE)			
	N	**Waste**	Municipal waste generation (ESTAT, CH)	Municipal solid waste (ESTAT)	Municipal solid waste	
	N		Non-mineral waste generation (ESTAT)			

	N		Generation of waste (UN)			
	N		Waste treatment and disposal (UN)			
	N		Changes in waste production (FR)			
	N	**Hazardous waste**	Generation of hazardous waste (ESTAT)			
	N		Management of radioactive waste (UN)			
	N		Nuclear waste (FR)			
	N	**Landfill**	Total waste from all sectors disposed of in landfill sites (UK)			
	N		Solid waste disposed of to landfill (DE)			
	N	**Recycling**	Waste recycling rate (CH, FR)			
	N		Proportion of population with access to kerbside recycling (NZ)			
	N		Proportion of packaging waste recycled (NZ)			
	I	**Imports**	Material requirement abroad for imports to Switzerland (CH)	Import of non-energy resources (OECD, ESTAT, UN)	Import of non-energy resources	Import of non-energy resources
Land and ecosystems	**N**	**Land (stock)**			Land assets	
	N	**Land use**	Land use change (UN)			
	N		Area of land used for farming (NZ)			
	N		Build-up areas (ESTAT)			
	N		Increase in land use for housing and transport (DE)			
	N		Land use for settlement (CH)			
	N		Area covered by agriculture, woodland, water or river, urban (UK)			
	N		Livestock density index (ESTAT)			
	N		New dwellings built on previously developed land or through conversions (UK)			
	N		All new development on previously developed land (UK)			
	N		Arable and permanent cropland area (UN, CH)			
	N	**Organic farming**	Organic farming (UN, ESTAT, DE, FR)			
	N		Area under agri-environmental commitment (ESTAT)			
	N	**Protected areas**	Proportion of terrestrial area protected, total and by ecological region (UN)			
	N		Management effectiveness of protected areas (UN)			
	N		Area of selected key ecosystems (UN)			
	N		Sufficiency of sites designated under the EU Habitats directive (ESTAT)			
	N		Land covered by environmental schemes (UK)			
	N	**Soil quality**	Contaminated soil sites (NZ)		Soil quality indicator	
	N		Soil health (NZ)			
	N		Land degradation (UN)			
	N		Land affected by desertification (UN)			
	N		Changes in soil artificialisation (FR)			

	N		Versatile soil extinction (NZ)			
	N		Nitrogen surplus (DE)			
	N		Nitrogen and phosphorus content in soil (NZ)			
	N		Percentage of Norway's land area where critical loads for acidification have been exceeded (NO)			
	N		Area of sensitive UK habitats exceeding critical loads for acidification and eutrophication (UK)			
	N	**Fertilizers**	Fertilizer use efficiency (UN)			
	N		Fertiliser input, farmland bird population, ammonia and methane emissions and output (UK)			
	N	**Pesticides**	Use of pesticides (UN, FR)			
	N	**Erosion**	Hill country erosion (NZ)			
	N	**Ecosystems (stock)**			Biodiversity indicator	Biodiversity indicator
	N	**Key species/habitats**	(a) Priority species status (b) priority habitat status (UK)			
	N		Abundance of selected key species (UN)			
	N	**Native species**	Distribution of selected native species (NZ)			
	N		Area of native land cover (NZ)			
	N	**Diversity**	Species diversity and landscape quality (DE)			
	N	**Pests/weeds**	Distribution of selected pest animal and weed species (NZ)			
	N		Abundance of invasive alien species (UN)			
	N	**Fragmentation**	Fragmentation of habitats (UN)			
	N		Landscape fragmentation (CH)			
	N	**Irreversable losses**	Irreversible losses of biologically productive areas (NO)			
	N	**Threatened species**	Change in threat status of species (UN)	Red list (ESTAT)	Red list	
	N		Number of threatened species (NZ)			
	N	**Birds**	Bird index (ESTAT, FR, NO, CH, UK)			
	N	**Forests**	Proportion of land area covered by forests (UN)			
	N		Percent of forest trees damaged by defoliation (UN, ESTAT)			
	N		Area of forest under sustainable forest management (UN)			
	N		Forest increment and fellings (ESTAT)			
	N		Ecological quality of forests (CH)			
	N		Deadwood (ESTAT)			
	N	**Fish/coral**	Proportion of fish stocks within safe biological limits (UN)			
	N		Fish catches taken from stocks outside safe biological limits (ESTAT)			
	N		Area of coral reef ecosystems and percentage live cover (UN)			
	N		Size of fishing fleet (ESTAT)			
	N		Proportion of catches at EU level only based on the state of fishery stocks (ESTAT)			
	N		Proportion of assessed fish stocks below target levels (NZ)			
	N		Spawning stock biomass and precautionary (Bpa) reference			

			point for North-East Arctic cod (NO)			
	N		Sustainability of fish stocks around the UK (UK)			
	I	**Land use**	Ecological footprint (CH)		Land footprint	Land footprint
Water	N	**Resources**			Fresh water resources	
	N	**Extraction**	Surface- and groundwater abstraction (ESTAT, UK)	Surface and groundwater extraction (OECD)	Surface and groundwater extraction	
	N	**Consumption**	Proportion of total water resources used (UN)			
	N		Litres per person per day (UK)			
	N	**Allocation**	Water allocation compared with total water resource (NZ)			
	N	**Intensity**	Water use intensity (UN)			
	N	**Waste water treatment**	Wastewater treatment (UN)			
	N	**Water quality**	Presence of faecal coliforms in freshwater (UN)		Water quality indicator	
	N		Biochemical oxygen demand in water bodies (UN)			
	N		Bathing water quality (UN)			
	N		Marine trophic index (UN)			
	N		Biochemical oxygen demand in rivers (ESTAT)			
	N		Inland water bodies classified as “clearly not at risk” (NO)			
	N		Coastal waters classified as “clearly not at risk” (NO)			
	N		Nitrate content in groundwater (CH)			
	N		Phosphorus content in selected lakes (CH)			
	N		Synthetic indicator of surface water quality (FR)			
	N		Nitrogen in rivers and streams (NZ)			
	N		Biological health of rivers and streams (NZ)			
	N		Lake water quality (NZ)			
	N		Groundwater quality (NZ)			
	N		Bacterial pollution at coastal swimming spots, rivers and lakes (NZ)			
	N		Rivers of good (a) biological (b) chemical quality (UK)			
	N	**Emissions**	Contributions by France to international sea and air transport emissions (FR)		Emissions to water	
	I	**Footprint**			Water footprint	Water footprint
Air quality	N	**General air pollution**	Ambient concentration of air pollutants in urban areas (UN)			
	N		Index of production of toxic chemicals, by toxicity class (ESTAT)			
	N		Air pollution (DE, NZ)			
	N		Assessment of local environmental quality (UK)			
	N		NH3, NOx, PM10 and SO_2 emissions and GDP (UK)			
	N	**PM10 concentration**	Particulate matter concentration (CH)	Urban exposure to particulate matter (ESTAT)	Urban exposure to particulate matter	Urban exposure to particulate matter
	N	**PM10 emissions**	Urban population exposure to air pollution by particulate matter (ESTAT)	Emissions of particulate matter (OECD, ESTAT)	Emissions of particulate matter	

	N		Emissions of particulate matter by source sector (ESTAT)			
	N	**Ozone concentration**	Urban population exposure to air pollution by ozone (ESTAT)	Urban exposure to ozone (ESTAT)	Urban exposure to ozone	
	N		(a) Annual levels of particles and ozone (b) days when air pollution is moderate or higher (UK)	Emissions of tropospheric ozone (OECD, ESTAT)	Emissions of tropospheric ozone	
	N	**Ozone emissions**	Emissions of ozone precursors by source sector (ESTAT)			
	N	**Acidifying emissions**	Emissions of acidifying substances by source sector (ESTAT)	Emission of acidifying emissions (OECD, ESTAT)	Emission of acidifying emissions	
	N	**Noise**	Proportion of population living in households considering that they suffer from noise (ESTAT)			
	N		Persons affected by noise (CH)			
Climate	N	**Surface temperature**	Global surface average temperature (ESTAT, NZ)	Global CO_2 concentration (ESTAT)	Global CO_2 concentration	Global CO_2 concentration
	N	**Historical CO_2-emissions**		Historical CO_2 emissions	Historical CO_2 emissions	
	N	**CO_2 emission**	Carbon dioxide emissions (UN, CH, UK)			
	N	**CO_2 intensity**	CO_2 intensity (CH)			
	N	**Greenhouse gas emissions**	Greenhouse gas emissions (UN, ESTAT, FR, DE, NZ, NO, CH)	GHG-Emissions (OECD, ESTAT)	GHG-Emissions	GHG-Emissions
	N		Energy-related greenhouse gas emissions (NZ)			
	N	**GHG intensity**	Greenhouse gas emissions intensity of energy consumption (ESTAT)	GHG-Emissions intensity (OECD, ESTAT)	GHG-Emissions intensity	
	N		Greenhouse gas intensity of the economy (NZ)			
	N	**Ozone concentration**	Ozone concentration (CH, NZ)	State of the ozone layer		
	N	**Ozone depleting emissions**	Consumption of ozone depleting substances (UN)	CFC emissions (OECD, ESTAT)		
	I	**Footprint**	Carbon footprint of the final national demand (FR)		Carbon footprint	Carbon footprint
	I	**Trade balance**			Carbon trade balance	
Labour	N	**Participation/ employment rate**	Employment-population ratio (UN)	Participation rate (OECD, ESTAT)	Participation rate	Participation rate
	N		Employment rate (ESTAT, DE,)			
	N		Participation rate (NZ			
	N	**Hours worked**	People of working age in employment	Hours worked (OECD, ESTAT)	Hours worked	
	N	**Un(der)employment**	Unemployment rate (NZ, CH, UK)	Unemployment rate (OECD, ESTAT)	Unemployment rate	
	N		Long-term unemployment rate (ESTAT, FR, NO)			
	N		Unemployment rate and under-employment rate (FR)			
	N	**Youth unemployment**	Youth unemployment rate (FR, CH)			
	N	**Replacement ratio**	Aggregate replacement ratio (ESTAT)			
	N	**Dependency ratio/over 65**	Dependency ratio (UN, ESTAT)			
	N	**Retirement age**	Average exit age from the labour market (ESTAT)	Average exit age labour market (ESTAT)	Average exit age labour market	
	N	**Unpaid work**	Formal unpaid work outside the home (NZ)			
	N	**Other**	Vulnerable employment (UN)			
	N		All-day care provision for children (DE)			
	I	**Brain drain**			Brain drain	

Physical capital	**N**	**Stock**	Real net stock of total assets per person (NZ)	Physical capital stock (ESTAT)	Physical capital stock	
	N	**Investment**	Gross fixed capital formation (UN, ESTAT, DE, CH, UK)	Gross capital formation (OECD, ESTAT)	Gross capital formation	Gross capital formation
	N	**ICT**	Internet users (UN, CH)			
	N		Mobile cellular telephone subscribers per 100 population (UN)			
	N		Fixed telephone lines per 100 population (UN)			
	N	**Infrastructure**	Real net stock of infrastructure per person (NZ)			
	I	**Export**		Export of physical capital (OECD, ESTAT, UN)	Export of physical capital	
Knowledge capital	**N**	**Stock**			R&D capital stock	
	N	**Investment**	Total R&D expenditures (UN, ESTAT, FR, DE, NZ, CH)	R&D expenditures (OECD, ESTAT)	R&D expenditures	R&D expenditures
	N	**Innovation**	Turnover from innovation (ESTAT)			
	N		Rate of innovation by type (NZ)			
	N	**Patents**	Patent applications (CH)			
	N	**R&D personnel**	Personnel involved in research and development (NZ)			
	N		Human resources in science and technology (CH)			
	I	**Spillovers**			Knowledge spillovers	
Financial assets	**N**	**Net assets/liabilities**		Assets minus liabilities (OECD, ESTAT)	Assets minus liabilities	Assets minus liabilities
	N	**Debt**	Debt to GNI ratio (UN)	Public debt (OECD, ESTAT)	Public debt	Public debt
	N		General government debt (ESTAT, FR, NZ, CH)			
	N		Ratio of debt services to export earnings (NZ)			
	N	**Current deficit**	Current account deficit as percentage of GDP (UN)			
	N		National deficit (DE)			
	N	**Pensions**	Pension expenditure projections (baseline scenario) (for sub-theme public finance sustainability) (ESTAT)	Pension wealth (OECD)		
	N		Generational accounts: Need to reduce public sector finances as a share of GDP (NO)			
	N		Proportion of working age people contributing to a non-state pension in at least three years out of the last four (UK)			
Monetized aggregates	**N**	**Economic capital**	Produced capital (WB)	Produced capital (WB)		
	N	**Financial capital**	Financial capital (WB)	Financial capital (WB)		
	N	**Natural capital**	Natural capital (WB)	Natural capital (WB)		
	N	**Human capital**	Human capital (WB)	Human capital (WB)		
	N	**Intangible capital**	Intangible capital (WB)	Intangible capital (WB)		
	N	**Total capital**	Comprehensive wealth (WB)	Comprehensive wealth (WB)		

G- Global, I – International, N - National

HEAD – Headline indicator, INV – Investment, DEPR – Depreciation, PROD – Productivity indicator, INT – Intensity indicator, OTHER – Other type of indicator

CH – Switzerland, DE – Germany, EB – Eurobarometer, ESS- European Social Survey, ESTAT – Eurostat, EUKLEMS – Productivity database (Eurostat), FR – France, MTUS – Multinational Time Use Surveys, NO – Norway, NZ – New Zealand, OECD – Organisation of Economic Cooperation and Development, UK – United Kingdom, United Nations – United Nations, WB – World Bank, WHD - World Happiness Database.

Sources Sustainable Development: United Nations - Commission on Sustainable Development (United Nations, 2007); Eurostat (2009); World Bank (2011); France (ICSD, 2010); Germany (FSOG, 2010); New Zealand (Statistics New Zealand, 2009); Norway; Switzerland (FSOS, 2009), United Kingdom (DEFRA,2010).

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