Survey of green growth / environmental sustainability accounting and indicators

Technical paper

Client: Department for International Development (UK)

Rotterdam, 6th April 2012

Survey of green growth / environmental sustainability accounting and indicators

Technical paper

Final

Client: Department for International Development (UK)

Matthew Smith

Rotterdam, 6th April 2012

ECORYS

About Ecorys

At Ecorys we aim to deliver real benefit to society through the work we do. We offer research, consultancy and project management, specialising in economic, social and spatial development. Focusing on complex market, policy and management issues we provide our clients in the public, private and not-for-profit sectors worldwide with a unique perspective and high-value solutions. Ecorys' remarkable history spans more than 80 years. Our expertise covers economy and competitiveness; regions, cities and real estate; energy and water; transport and mobility; social policy, education, health and governance. We value our independence, integrity and partnerships. Our staff are dedicated experts from academia and consultancy, who share best practices both within our company and with our partners internationally.

Ecorys Netherlands has an active CSR policy and is ISO14001 certified (the international standard for environmental management systems). Our sustainability goals translate into our company policy and practical measures for people, planet and profit, such as using a 100% green electricity tariff, purchasing carbon offsets for all our flights, incentivising staff to use public transport and printing on FSC or PEFC certified paper. Our actions have reduced our carbon footprint by an estimated 80% since 2007.

ECORYS Nederland BV
Watermanweg 44
3067 GG Rotterdam

P.O. Box 4175
3006 AD Rotterdam
The Netherlands

T +31 (0)10 453 88 00
F +31 (0)10 453 07 68
E netherlands@ecorys.com
Registration no. 24316726

W www.ecorys.nl

ECORYS   AE25268

Table of contents

1 Summary

This study conducted a survey of the major green growth frameworks and indicators to improve understanding of their function, pros, cons and the links between them. The questions it set out to answer are presented below with summary answers based on our opinion and judgement, and the evidence and information reviewed in preparing this study (please refer to main body of report).

The tables on the following pages provide a summary of the main frameworks and indicators reviewed in this study. A distinction is drawn between 'direct' frameworks and indicators that specifically address and measure environmental economic issues, and 'indirect' indicators that are related to the broader area of sustainability and social indicators.

The methodological links between the frameworks and indicators are described in the figure below, this illustrates the importance of the System of National Accounts (SNA) and the System of Environmental Economic Accounting (SEEA) frameworks, which underpin almost every indicator in this field, as represented by the overlaps and connections between them. The other indicators do also have their own independent methods and aspects.

Green growth frameworks and indicators: links & relationships
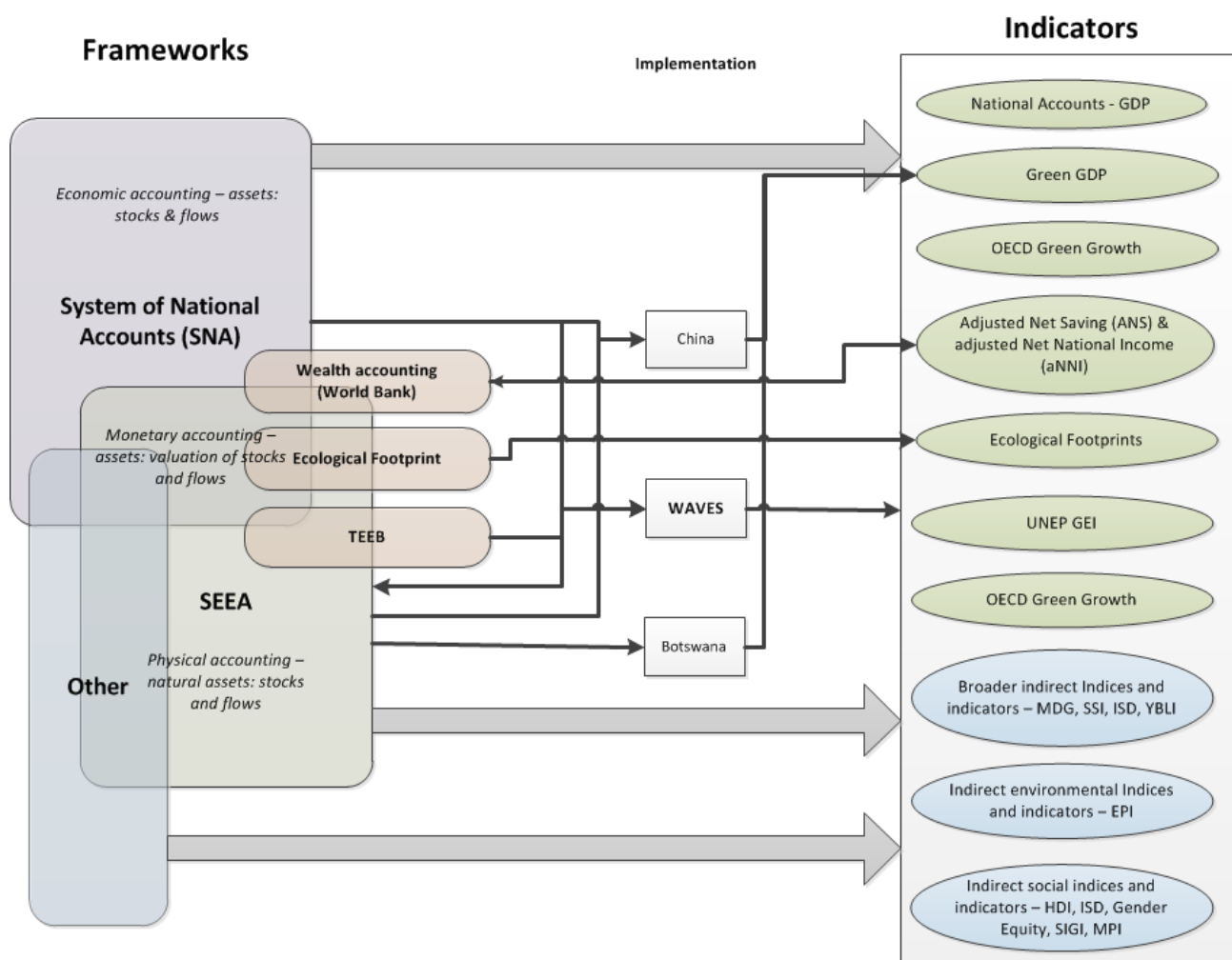
Table 1 Summary of directly relevant green growth indicator / framework characteristics

	System of Environmental-Economic Accounts (SEEA)	Adjusted Net Savings (ANS) – World Bank	WAVES -World Bank	Ecological Footprint - Global Footprint Network	OECD green growth indicators	UNEP Green Economy Initiative (GEI)
Organisation	UN (UNSD)	World Bank	World Bank	Global Footprint Network	OECD	UN (UNEP)
Description	The SEEA is a framework methodology to incorporate the environment into national economic accounts,	A measure that attempts to better reflect the sustainability of a national economy by looking at depletion and investment in capital, including natural resource capital.	Awareness raising to introduce the practice of ecosystem valuation into national accounts at scale so that better management of natural environments becomes "business as usual".	A resource accounting tool which measures how much land and water area a human population requires to produce the resource it consumes.	Indicator system consisting of four indicator groups (approximately 25 indicators) with the aim of sending clear messages to policy makers and the public at large.	UNEP developed a framework for environmental indicators to identify key indicators of air, water, land and biodiversity. Special in their approach is the use of sectoral indicators.
Created	Created in 1993 following Rio '92, revised every 10 years: 2003 & 2013. Current revision underway, first element – central framework – now approved.	The ANS approach has been developed since 2002, it was presented in the Where is the Wealth of Nations? report in 2006.	October 2010 – next meeting April 2012 Implementation planned 2012-2015	Founded 2003 – Living Planet Report 2010	2011 "Towards green growth: Monitoring Progress – OECD Indicators"	2008 – Last report 2011
Objective	- To integrate environmental stocks and flows in national economic accounts - To provide better information to policy makers to make more informed decisions,	To provide national-level decision makers with a clear, relatively simple indicator of how sustainable their country's investment and natural capital management policies are.	WAVES: - Implement natural capital and/or ecosystem accounting in 6-10 countries. - Incorporate the accounts into policy analysis and development planning and promote adoption beyond the pilot countries. - Test and develop internationally accepted and standardized guidelines for the implementation of ecosystem accounting.	- Point out new solutions and spark a global dialogue about ecological limits and overshoot - Develop an international Footprint standard	- Understanding of the different factors affecting green growth - Providing internationally comparable data - Fostering sustainable economic development	- To assist countries in developing a framework on indicators for measuring progress on environmental sustainability; - Capacity building on development of indicators framework for environmental performance assessment; and - To facilitate the assessment of state of the environment and sustainable development at the subregional level.
Type	Framework	Indicator	Application	Indicator	Indicator set	Indicator set
Construction	Builds on system of national accounts (SNA). Based on stocks and flows of the economy and environment. Calculated in physical, monetary and financial	Derived primarily from SNA data. Based on calculation of produced, natural and intangible capital.	The WAVES pilots could potentially use a variety of methodologies and constructions. The clearest links are to SEEA, TEEB and the World Bank – ANS.	Calculates both the Ecological Footprint (demand on nature), and biocapacity (capacity to meet this demand)	25 indicators, across 5 categories. Typically sourced from existing datasets from national accounts or other agencies.	GDP, calories per capita, population below US$ day, Human Development Index (HDI), employment in green investments sectors (from agriculture to transportation), forest land, water

	System of Environmental-Economic Accounts (SEEA)	Adjusted Net Savings (ANS) – World Bank	WAVES -World Bank	Ecological Footprint - Global Footprint Network	OECD green growth indicators	UNEP Green Economy Initiative (GEI)
	terms.					demand, waste generation, total landfill, biocapacity or ecological footprint, CO2 emissions, primary energy demand, and the share of renewable energy in primary demand
Scope:	The Central Framework covers environmental and economic assets, with a primary focus on: • Land • Energy • Water • Forests / Timber • Air (emissions) Experimental Ecosystem accounts are also being developed.	Wealth of nations cover the following environmental and natural capital depletion and degradation. • Energy and mineral resources • Timber forest resources • Non-timber forest resources • Crop land • Pasture land • Protected areas • Emissions to air (GHG, particulates) Also explicitly considers investment in education.	WAVES pilots focus and scope will vary by country – overall, within a general environmental-economic accounting structure it is likely to have an ecosystem based focus.	3 main areas: • primary products (from cropland, forest, grazing land and fisheries) • demand for food, fibre, timber, energy and space for infrastructure • carbon dioxide emissions	5 main areas: • Environment and resource productivity of the economy • Natural asset base • The environmental dimension of quality of life • Economic opportunities and policy responses • Socio-economic context and characteristics of growth	Since 2012 concentration on three types of indicators: • economic transformation • resource efficiency • progress and well-being. In areas of: Agriculture, fisheries, water, forests, renewable energy, manufacturing industry, waste, buildings, transport, tourism
Land	X	X	?	X	X	X
Ecosystems	X [tbd]		Very Likely	X	X	
Forests	X	X	?	X	X	X
Fisheries	X		?	X	X	X
Biodiversity	X [tbd]		?		X	
Air	X	X	?	X		X
Water	X	X	?	X	X	X
Materials	X	X	?	X	X	X
Take-up	Revision of central framework recently approved. At least 25 countries implemented some form of environmental accounts to date, using the SEEA to varying	ANS data is prepared by the World Bank for approximately 120 countries	• Meeting 2011: Australia, Canada, Columbia, France, India, Japan, Netherlands, Norway, UK, US and IO's and NGO's • Pilot countries: Botswana, Colombia,	National Footprints are produced for over 150 countries The GFN has membership from around 200 cities, 23 nations, leading	Varies by indicator. Netherlands has undertaken the most comprehensive assessment based on the OECD indicator set.	20 countries

	System of Environmental-Economic Accounts (SEEA)	Adjusted Net Savings (ANS) – World Bank	WAVES -World Bank	Ecological Footprint - Global Footprint Network	OECD green growth indicators	UNEP Green Economy Initiative (GEI)
	extents.		Costa Rica, India, Madagascar and Philippines	business, scientists, NGOs, academics (a network of 90 global partners)		
Results	The revised SEEA framework is expected to be the international standard for the foreseeable future. [	• The Changing Wealth of Nations: Measuring Sustainable Development for the New Millennium (World Bank 2010) • Data published annually	• 2012 Preliminary report to Rio+20 Summit	• Frequently published reports • Frequently updates data	Some indicators already published on website.	Success stories from projects highlighted under the GEI as a whole published on website.
Pros	• Builds on SNA • Will be internationally agreed standard. • Strong stakeholder involvement • Physical and monetary stocks and flows • Wide scope • Brings together and standardises best practices from past experiences over 20 years	• Single clear indicator • Draws on accessible SNA data • Relatively easy to calculate • Data requirements relatively light • Includes range of natural resources	• Aligned with SEEA • Build on TEEB • Well financed ($15 million) • Supporter by a wide forum of partners	• Applicable on an individual, a region, all of humanity, or a human activity • Easy to visualize and communicate	• Environment and economy seen as one • Comprehensive approach • Indicator set can cover wider scope and other dimensions, e.g. social, production and consumption	• Logical summary of relevant areas • Broad concept with detailed elaboration of indicators
Cons	• Is only a data system, does not drive sustainability on its own • Accounting for non-renewable resources • Valuation of resources • Quality aspects not included • Social dimension not included • Alignment of environmental sector with SNA – ISIC categories is weak	• Substitutability of environmental capital • Investment does not always equal quality / outcomes • Focus on production perspective • Social dimension not included • Valuation of resources • Questions on assumptions – discount rates, sustainable consumption growth rates, capital asset lifetimes	Will depend on approaches taken – problems similar to SEEA and WAVES are likely.	• Over simplifies issues • Narrow scope • Weak differentiation between energy impacts. • Only valid for materials that are created by biological processes • Bias to large, sparsely populated countries • Limited policy relevance	• Indicator set is more complicated to communicate • Difficult to find data for all indicators • Gaps in scope – i.e. adaptation and resilience • Large assumptions behind some indicators – especially resource flow base data • Use of ratio indicators relies on assumed relationship	• No immediate relevance for those interested in regional discussion • Data requirements • Weak linkages to other issues relevant to mainstreaming the environment
Links	Framework works with all major organisations in this field, will link to almost all.	From SNA, to WAVES, OECD and other indicators e.g. SSI (see 3.3)	Likely to be connected/ based on TEEB and SEEA. Also Poverty-Environment Initiative, UK National Ecosystem	Human Development Index. Attempts being made to link to SEEA.	Cooperation with UNEP and Eurostat. Alignment with SEEA – many indicators will be derived from it.	Links within UN and also through Green Growth Knowledge Platform to World Bank, OECD and others.

	System of Environmental-Economic Accounts (SEEA)	Adjusted Net Savings (ANS) – World Bank	WAVES -World Bank	Ecological Footprint - Global Footprint Network	OECD green growth indicators	UNEP Green Economy Initiative (GEI)
			Assessment, The Natural Capital Project			
Data source / reference	http://unstats.un.org/unsd/envaccounting/seea.asp		available at: http://www.worldbank/programs/waves http://www.proecoserv.org/information-hub/doc_view/34-proecoserv-wb-waves-lange.raw?tmpl=component	available at: http://www.footprintnetwork.org	available at: http://www.oecd.org/document/58/0,3746,en 2649_37425_48303098_1_1_1_37425,00.html OECD (2011) Towards Green Growth OECD (2011) Towards Green Growth - Monitoring Progress: OECD Indicators	available at: http://www.unep.org/IEACP/iea/training/manual/module5/1214.aspx http://www.unep.org/greeneconomy/Portals/88/GE_INDICATORS%20final.pdf

Table 2 Summary of indirectly relevant to green growth indicator / framework characteristics

	Multidimensional Poverty Index (MPI)	Millennium Development Goals (MDGs)	OECD Your Better Life Index	Indices of Social Development (ISD)	Human Development Index (HDI)	Sustainable Society Index (SSI)	Social Institutions and Gender Index (SIGI)	Gender Equity Index
Organisation	Oxford Poverty and Human Development Initiative (OPHI)	United Nations	OECD	International Institute of Social Studies (ISS), Erasmus University	Created by; managed by UNDP	Sustainable Society Foundation	OECD. Göttingen University and Erasmus University Rotterdam	Social Watch
Description	International index assessing acute multidimensional poverty by measuring 10 indicators that cover aspects related to health, education and living standard.	The Millennium Development Goals (MDGs) are eight targeted development aims designed to free humanity from extreme poverty, hunger, illiteracy and disease by 2015.	Interactive tool allowing users to allocate importance to 11 topics contributing to wellbeing in OECD countries.	Aggregate index of five distinct dimensions of social development	A composite index measuring average achievement in three basic dimensions of human development—a long and healthy life, education and a decent standard of living.	The SSI is an index measuring progress towards sustainable development. It covers aspects related to human, environmental and economic wellbeing.	The Index is a comparative approach to measure gender equality, based on the OECD's Gender, Institutions and Development Database.	The Gender Equity Index (GEI) measures gender inequalities around the world based on three dimensions, education, economic participation and empowerment.
Created	Launched in July 2010; new data included in 2011	September 2000	May 2011	Launched March 2011	Developed in 1990; revised in 2010	2006 and is updated every two years.	Construction and latest results from 2009	2004 computed by Social Watch, latest version 2012
Objective	- create a comprehensive picture of people living in poverty - compare incidence and intensity of poverty both across countries, regions and the world and within countries by ethnic group, urban or rural location	Reach MDGs by 2015	The Index aims to involve citizens in the ongoing debate on measuring the well-being of societies, and to empower them to become more informed and engaged in the policy-making process that shapes everybody's life.	- Provide better aggregate measures of social development than are currently available - Enable comparison of countries' performance concerning social development - Help policy-makers focus on areas where a concentrated development policy can add true value	The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone.	- Provide an easy and transparent instrument to measure the level of sustainability of a country and to monitor progress to sustainability - stimulate progress on the way towards sustainability	- Showing regional disparities in gender equality - Investigate regional trends - Describe gender equality changes and developments over time	- make gender inequities more visible - illustrate gaps between women and men in different areas - monitor the evolution in the different countries of the world
Type	Indicator	Indicator	Indicator	Index	Indicator	Indicator	Indicator	indicator

	Multidimensional Poverty Index (MPI)	Millennium Development Goals (MDGs)	OECD Your Better Life Index	Indices of Social Development (ISD)	Human Development Index (HDI)	Sustainable Society Index (SSI)	Social Institutions and Gender Index (SIGI)	Gender Equity Index
Construction	The MPI relies on three main databases that are publicly available and comparable for most developing countries: the Demographic and Health Survey (DHS), the Multiple Indicators Cluster Survey (MICS), and the World Health Survey (WHS).	8 goals, measured through 21 targets and 60 official indicators: Data is typically drawn from official statistics provided by governments to the international agencies responsible for the indicator. To fill data gaps, data for many of the indicators are supplemented by or derived exclusively from data collected through surveys sponsored and carried out by international agencies.	The data mostly come from official sources such as the OECD or National Accounts, United Nations Statistics, National Statistics Offices. A couple of indicators are based on data from the Gallup World Poll. More than 80% of the indicators in *Your Better Life Index* have been already published by the OECD.	The indices are composed from 25 reputable data sources for 193 countries, over the period from 1990 to 2010, and are updated as new data becomes available.	The HDI is, to the extent possible, calculated based on data from leading international data agencies (e.g. UN DESA, UNESCO, World Bank, IMF) and other credible data sources available at the time of writing.Many data gaps still exist in even some very basic areas of human development indicators.	Data sources for each dimension Human wellbeing: FAO, WHO, UN Population Division, UNESCO, World Economic Forum, World Bank Environmental wellbeing: Environmental Performance Index, IEA, CDIAC, MDG Indicators, WRI, Aquastat, FAO, IUCN Economic wellbeing: Global Footprint Network, FIBL, World Bank, IMF, CIA World Factbook, ILO	12 innovative indicators on social institutions, which are grouped into 5 categories. The range goes from 0 (totally equal) to 1 (fully unequal)	Eleven indicators in three dimension scale from 0 (e.g. no women is educated at all and all men are) to 100 (perfect equality). The indicators are also weighted according to population to account for disparities in the population UNESCO and IPU data are used to calculate indicators of the dimensions
Scope:	10 indicators covering three dimensions: - Education: - Health: - Living standard:	- Poverty and hunger - Education - Gender equality - Health - Environmental sustainability - Development	11 topics, measured by 25 individual indicators: - Community; - education; - environment; - governance; - health; - housing; - income; - jobs; - life satisfaction; - safety; - work-life balance	Five dimensions covered; - Civic Activism - Clubs and Associations - Intergroup Cohesion - Interpersonal Safety and Trust - Gender Equality	Three different dimensions, measures with four indicators: - Health - Education - Living standards	The SSI covers 3 wellbeing dimensions, using 8 different categories, which are measured with 24 indicators (3 per category) - Human wellbeing - Environmental wellbeing - Economic wellbeing	Ranks gender on following issues - Family Code - Physical Integrity - Son Preference - Civil Liberties - Ownership Rights	Ranks gender on following issues - Education - economic participation - women empowerment

	Multidimensional Poverty Index (MPI)	Millennium Development Goals (MDGs)	OECD Your Better Life Index	Indices of Social Development (ISD)	Human Development Index (HDI)	Sustainable Society Index (SSI)	Social Institutions and Gender Index (SIGI)	Gender Equity Index
Take-up	The 2011 Human Development Report (HDR) presents estimates for 109 countries with a combined population of 5.5 billion (79% of the world total).	Near universal coverage, but limited by data availability	Covers the member states of the OECD (34 countries) Over time, the Index will expand to cover the OECD's six partner countries: Brazil, China, India, Indonesia, Russia, and South Africa.	193 countries covered	In 2011, the HDI has been calculated for 187 countries and territories.	151 countries covered	124 non-OECD countries,	Covers 168 countries on all continents (version 2012)
Results	About 1.7 billion people in the countries covered—a third of their entire population—lived in multidimensional poverty between 2000 and 2010. This exceeds the estimated 1.3 billion people in those countries who live on $1.25 a day or less (though it is below the share who live on $2 or less).	Positive progress on poverty reduction, education, child mortality, malaria control, tuberculosis, drinking water and HIV/AIDS. Less progress on: child nutrition, employment, sanitation, housing.	Country performance according to OECD Better Life Index: • Exceptionally well: AU, CA, DK, NO, NZ, SE • Very well: AT, BE, CH, DE, FI, FR, IE, IS, LU, NL, UK, US • Favourably: CZ, ES, IL, IT, JP, SI • Moderately well: EL, HU, KR, PL, PT, SK • Low: CL, EE, MX, TR	Achievements and challenges facing societies across the world: from the richness of community life in Sub-Saharan Africa, to the high levels of personal safety and security in the Persian Gulf, to violence in the Caribbean. mprovement over time: the growth of civic engagement in Eastern Europe, gender empowerment in the Middle East, or inclusion of minorities in Southern Africa.	Since 2006, Norway, Australia, the Netherlands, the United States and New Zealand have formed the top five of countries with the highest HDI. During the same time period, Chad, Mozambique, Burundi, Niger and DR Congo have been the five least developed countries.	The world at large is – with a score of 5.9 on a scale of 0 to 10 – only just over halfway to a sustainable world. Economic Wellbeing is lagging behind the environmental and human wellbeing. North & West Europe show the highest SSI score of all regions, 6.9, whereas Sub Saharan Africa has the lowest score of 5.3.	High level of discrimination in South Asia, sub-Saharan Africa and the Middle East and North Africa. Half of the countries at the bottom of the index are located in sub-Saharan Africa At the top, we find countries from Latin America, Eastern Europe and Central Asia with Paraguay on top; Sudan is the country that occupies the last position, followed by Afghanistan, Sierra Leone, Mali and Yemen	The gender gap is not narrowing in most countries Europe and North America scores top with (73), the East Asia and Pacific (69), Latin America and the Caribbean, (68), Central Asia (64), Sub-Saharan Africa (52), Middle East and North Africa (43), and South Asia (39) No country in the world has reached GEI 90 points or more, meaning that no country has yet reached the acceptable level

	Multidimensional Poverty Index (MPI)	Millennium Development Goals (MDGs)	OECD Your Better Life Index	Indices of Social Development (ISD)	Human Development Index (HDI)	Sustainable Society Index (SSI)	Social Institutions and Gender Index (SIGI)	Gender Equity Index
Links	Human Poverty Index: The MPI replaced the HPI which was unable to identify specific individuals, households or larger groups of people as jointly deprived. Millennium Development Goals: The MPI indicators are drawn from the MDGs as far as the available internationally comparable data allow. The 10 indicators of the MPI are identical, or relate, to MDG indicators: nutrition (MDG 1), child mortality (MDG 4), access to drinking water (MDG 7), access to sanitation facility (MDG 7) and use of an improved source of cooking fuel (MDG 9).	To other UN programmes, OECD, national governments. MDGs are internationally significant, Also see MPI	The dimensions 'education' and 'health' of the HDI are also covered in the OECD Your Better Life Index, but the indicators used for measuring are not always the same.	Dimension of gender equality relates to MDG Goal 3. See also SSI	Not related to environmental sustainability MPI covers the same dimensions as the HDI, but the indicators used for measuring are not identical. See OECD YBLI. Also education and health dimensions also relate to the MDG Goals 1, 2, 4 and 5. Again, the indicators used differ.	The SSI uses data directly from the EF, ANS and EPI approaches listed in section 3.2, some indicators also very closely align with the OECD Green growth indicators. The 'human wellbeing' dimension covers the three dimensions of the MPI but the indicators used differ. Except for MDG Goal 8, all other MDG Goals are more or less covered by the SSI. Many of the topics of the OECD Your Better Life Index are covered by the SSI, but again, their measurement differs. The only overlap between the ISD and the SSI lies in the topic of gender equality. The dimensions of the HDI are included in the categories 'personal development' and 'economy'.	The index that comes closest to the SIGI is the Women Social Rights Index (WOSOC) Overlap with ISD (Gender Equity) The Indicator is related to other indicators, (the Gender-related Development Index (GDI) and the Gender Empowerment Measure (GEM), the Global Gender Gap Index (GGG), the Women's Social Rights Index, the Gender Gap Index Capped and a revised Gender Empowerment Measure) but non-redundant, it measure a special aspect of gender inequality, namely social institutions	Built on the same framework as the HDI and the IHDI • similar results of Social Watch (GEI) and the UNDP's (GII) • overlaps and similarities with HDI and ISD
Data source / reference	OPHI (2011) MPI Research Brief. UNDP (2012) Multidimensional Poverty Index (MPI).	UNDP (2011) The Millennium Development Goals Report 2011.	OECD (2011) Your Better Life Index:	ISS (n.d.) Indices of Social Development	UNDP (2011) Human Development Index and its component.	SSF (2010) Sustainable Society Index.	OECD	Social watch

The following section summarises the research towards answering the key questions asked in the terms of reference.

Are there any fundamental/ideological/definitional differences between the identified indicators/frameworks? Do any of them aim to do something fundamentally different to the rest? Is this justified?

The major fundamental difference between the surveyed frameworks and indicators is whether their underpinning basis is production or consumption based. Within the three major green growth frameworks, the System of Environmental Economic Accounts (SEEA), the World Bank Adjusted Net Savings (ANS) approach and the Ecological Footprint (EF), the SEEA and ANS frameworks take a production approach, and the EF is the only one to take a consumption approach. The indicators derived from these also tend to follow these formats, although indicator sets prepared by others, such as the OECD, UNEP and other NGOs are able to cover both, but often with a lean towards a production perspective, and indicators prepared from SEEA could take a consumption perspective.

This production basis is consistent with the existing economic information framework, the System of National Accounts (SNA) and the data already collected for GDP measures, which is also structured in this way. This makes it easier and simpler to integrate with existing systems to measure green growth in a context similar to GDP. Yet measuring on a production basis does not directly link to wellbeing, problems in selecting prices and values exist and, importantly, it will reflect poorly on resource producing countries in environmental accounts. This is important in the context of solutions to global problems such as climate change where attribution of responsibility is vital. The consumption perspective offers an approach which is more clearly linked to wellbeing and wealth and is argued a better approach to measuring sustainability. There are also problems with a consumption based approach, such as dealing with non-market consumption, equity and data.

Practically speaking, for the short term and where data and accounting capacity is weak, it appears better to take a production perspective. But it should be recognised that there are important implications of this choice in a development context, with many countries being resource suppliers for developed country consumers. The Stiglitz report concluded on this subject that a consumption based approach, supported by other relevant indicators and data, i.e. on environmental thresholds, equity and social aspects, would be the preferred approach for measuring sustainable growth and therefore this would be a useful long-term goal.

Is there reason to favour a policy approach that aims to strengthen either Category 1 or 2, or is there reason to pursue both?

Actual work on national environmental accounting is limited to a few examples at present and these have been controversial and not always successful, e.g. Green GDP measures in China. If it is a priority to move to more sustainable economic development then, as argued clearly in the Stiglitz report, appropriate measures are needed to influence decision makers.

This is particularly relevant for category 1 (direct) indicators for which there are currently only limited take up and integration, in terms of both issues covered and geographical coverage. Category 2 (indirect) indicators are much more developed overall, driven by the longer standing commitment to development and monitoring processes that have evolved with this. These remain important complementary indicators and are relevant to a broader view of sustainability.

For policy it would be useful to support measures to strengthen category 1 frameworks, particularly the implementation and revision of SEEA, and, to a lesser extent, ANS. As part of supporting SEEA there is the possibility to help define the key indicators that can be derived from the accounts.

Policy already typically supports the indicators in category 2, or these are prepared by NGOs and other organisations. These indicators offer good potential to link to category 1 indicators to better account for the social dimension in a development context. In strengthening the framework to derive indicators in category 1, policy could equally also target an expansion of the scope of indicators in category 2 to better incorporate environmental sustainability. Indicators such as ANS, aNNI and those within the OECD green growth set provide examples of those that could be prioritised.

Which are the more robust indicators/frameworks?

The SEEA framework is based on extensive work by a variety of agencies and therefore can be judged to have a robust foundation. It has also necessarily focused in its central framework on the issues and methodological aspects for which evidence is clearest and international agreement is strongest. Subsequent modules on ecosystem accounting will address more complex areas.

The ANS – Wealth approach of the World Bank, draws on many of the same factors accounted in the SEEA and has developed and established a methodology over the last 5-10 years. The theoretical base can be justified and the data is mostly based on SNA data or recognised international sources. Some of the assumptions on values, lifetimes and discount rates could be questioned, but the framework can be seen to be relatively robust.

The methodology proposed for the WAVES approach plans to be aligned with the SEEA, but will also go beyond it to test some approaches to ecosystem accounting. The final methodologies to be used are not yet clear.

The Ecological Footprint has strong academic foundations and draws upon latest work in this area to update and refine the methodology. This is a strength of the EF, but many of the assumptions underlying the footprint measures, and the method itself, although based on academic research, remain contentious in how they are derived and applied. There is a perception that this measure is less robust.

The OECD Green Growth and UNEP GEI indicators are generally derived from SNA and other data collected by international organisations. These data sources and institutions tend to be well respected and considered relatively robust.

Which are the most comprehensive indicators/frameworks?

The SEEA framework is working towards comprehensive coverage across all environmental economic aspects, but some of the more difficult areas, such as ecosystems and biodiversity, are not dealt with in the central framework of the system, and will be dealt with by supplementary advice and extensions.

The ANS approach is narrower than the SEEA, and while accounting for forests, land-use change, material use, water and emissions, it does not include ecosystems, biodiversity or fisheries.

The WAVES approach is not yet well defined, it is most likely to build from SEEA but also incorporate and test aspects of ANS and TEEB, and by directly testing methodologies for ecosystems it would have more comprehensive coverage.

The Ecological Footprint offers coverage across many ecosystem issues but is weak on non-natural materials (except for fossil fuels) and biodiversity. This provides a narrower view of ecological sustainability, rather than the environment as a whole.

The OECD and UNEP indicator sets, by their nature as sets, can also offer comprehensive coverage across the main issues and aspects, being able to more clearly link them together. The trade off is in simplicity of communication and need to develop and manage more data.

Which indicators/frameworks have been most popular to date?

The SEEA framework has only recently been revised and so there is limited application in practice. The existing SEEA 2003 framework has been used by around 25 countries to support their preparation of environmental economic accounts.

The ANS - Wealth of Nations work has considerable coverage with 120 countries measured in the latest version. The Ecological Footprint also has wide coverage, with national footprints available for over 150 countries. The OECD green growth indicators have lesser coverage, some indicators are available for a range of countries but as yet only 1 country (the Netherlands) has produced a comprehensive assessment.

The WAVES approach is set to be trialled in the 6 pilot countries in the next few years.

There is considerable contrast in take-up of category 1 and category 2 indicators, with the latter generally providing much more comprehensive coverage. These differences in the coverage of the countries could be explained by various factors. First of all, the complexity between category 1 and category 2 is relatively striking. The calculations and data requirements for category 1 frameworks and indicators are, in most cases, more extensive and time consuming and require investment by national statistic offices, whereas in category 2 international and transnational organisations – including development agencies - are more highly involved and this reduces the burden, this is particularly relevant in developing countries.

Related to this cost issue, is a value for money and/or transparency/governance type issue, where pilot environmental accounting projects established in developing countries have failed because the practical benefits of natural capital accounting could not be adequately demonstrated to the responsible policy-makers, or perhaps threatened to highlight unsustainable practices that would reflect badly on them, as proved the case in China and the failure of its Green GDP initiative.

Additionally, another factor is that some indicators are designed for a certain purpose, i.e. ANS is more geared towards measuring if resource rents are used to sustainably grow an economy, and can therefore be less relevant in countries with low resource endowments.

Which have the easiest data requirements and/or use data that is relevant for other purposes (thus providing value for money)? What other purposes are these?

The SEEA approach can be the most data intensive of the approaches, demanding additional physical supply and use data, although in practice this is often not the case, as the accounts use

monetary data from the SNA to derive the physical data (e.g. spending on energy products to provide information on carbon emissions). The SEEA also requires work to establish appropriate discount rates and valuations in a national context. This will be in addition to the data already collected for the SNA, and likely to impose additional costs on those preparing economic environmental accounts.

The ANS – World Bank approach draws on a variety of SNA and international data sources (i.e. FAO), as these are already routinely collected the additional data gathering elements are relatively low and the results are produced annually by the World Bank.

Similar conditions to SEEA are likely for the WAVES approach, and although some of the data gathering mechanics will already be in place from the SNA and previous in-country work, the ecosystem aspects will demand additional data. The burden of this will depend on the information gathering capacity in each country. Those selected for WAVES have already made some progress on environmental accounting so this burden is likely to be less than for countries starting from scratch.

The OECD and UNEP data sets are primarily based on indicators already collected for other purposes, these being repackaged or combined to make them relevant to green growth.

In terms of using these frameworks and indicators, the SEEA approach will impose the greatest additional information and data requirements and will also make the biggest demands on institutional capacity. As a benefit the results from applying SEEA are likely to be more instructive and useful for the user country. It would be useful to support countries committed to environmental accounting to move in this direction.

Where commitment from a country is weak then using international data sources, such as the World Bank ANS or OECD and UNEP indicators, can be a more cost effective way to help build understanding of the economic importance of environmental sustainability. This would be a good starting point for slowly moving towards a more comprehensive SEEA type approach. Where international data for a country is unavailable then support would be better targeted to establishing general national economic accounting capacity, perhaps embedding environmental accounting from the outset.

Are there any examples of indicators/frameworks in Category 2 that do or have the potential to include a wide, comprehensive range of environmental/sustainability information?

A selection of the category 2 indicators already incorporate an environmental sustainability dimension. Notable amongst these are the MDGs which have goals related to the environment, although mostly human development in focus, and the SSI which explicitly contains the environment as one of its 3 dimensions, which has relatively broad but shallow coverage of environmental factors. These 3 dimensions, the economic, social and environment are closely aligned with definitions of sustainability.

It would be possible to argue for many of the measures, that there is an environmental dimension to the issues they target such as poverty, health, gender, living standards and wellbeing, and therefore that this could and should be integrated into them, for example unsustainable exploitation of a renewable resource can have short and long term poverty and environmental impacts. This also highlights that measures can be sustainable in one or two aspects but not in the third, economic or social improvements, often tied to environmental degradation.

Which indicators relate most closely to the "beyond GDP" valuation approaches?

Beyond GDP as an approach is based on going beyond existing measures of GDP to measure not just economic production but to measure progress through wellbeing. The approaches reviewed in this study tend to be more 'extending GDP' type measures, looking to improve the information available to policy makers, better incorporating social and environmental aspects, rather than specifically focusing on wellbeing.

The SEEA framework is clear on this, it accounts for environmental assets, but does not go beyond this to the social or wellbeing impacts of the changes in these.

The ANS approach is most clearly an extension of GDP, taking GDP components in its calculation and, along with supplementary environmental and market data, using these to produce an adjusted single adjusted net savings figure. This can be argued to better incorporate sustainability by pointing towards impacts on future wellbeing, as implied by the investment (saving) for the future.

The EF approach does not align closely with a beyond GDP framework, as it does not account for wellbeing or deal well with non-ecological issues, though it does introduce the useful concept of bio-capacity which could be developed to better understand global sustainability thresholds and limits.

The UNEP GEI and OECD approaches offer wider insight into social and environmental issues with some, particularly within the UNEP GEI, specifically looking at wellbeing and therefore being relevant to Beyond GDP. The use of indicator sets in both these cases is interesting, in that they do not provide a single indicator, such as an extended GDP approach, but they do provide distinct and individual measures. Having this specificity is useful, as wellbeing and sustainability are separate issues, indeed a 'dashboard' type approach to sustainability and wellbeing indicators is recommended by the Stiglitz report[1].

The OECD Your Better Life Indicators and the Sustainable Society Index are indirect indicators that offer the closest alignment with a beyond GDP approach, one that focuses on wellbeing, though their environmental sustainability aspects are weaker than the direct indicators reviewed.

Are any important indicators left out of "beyond GDP" valuation approaches? Are more indicators included in "beyond GDP" valuation approaches? What is the rationale?

As described above, the Beyond GDP approach focuses on progress as seen in improved wellbeing. An important potential gap in this is that of environmental sustainability, to the extent that measures account for only current wellbeing, without reference to how this is achieved by unsustainable behaviour, i.e. 'borrowing' from future wellbeing. A dashboard of indicators is recommended to adequately cover this dimension and to try to include the difficult issue of what impacts unsustainable behaviour could actually have.

It is apparent that between the indicators reviewed in this study every aspect of Beyond GDP can be covered and from a variety of perspectives. The weakest points from the range of indicators and potential areas of focus for strengthening are building from production-based measures, towards a more consumption-based perspective, biodiversity measures and value and incorporating quality dimensions into measures.

---

[1]   Stiglitz, Sen and Fitoussi (2009) Report by the Commission on the Measurement of Economic Performance and Social Progress

The first issue appears simpler to address, given that relevant data will already be available through the SNA, it is more a matter of persuading policymakers and statisticians to looks at the data differently. Biodiversity and quality measures are much more complex methodologically and less suited to valuation, further work remains to be done in this area to address these issues, the ecosystems section of the SEEA and approaches tested by WAVES are among the current initiatives which will move this forward. Quality dimensions will also remain a crucial but complex area of focus, it is essential that data and measures in this area are improved if real changes in wellbeing are to be understood and policy adjusted accordingly.

2 Introduction

Ecorys were appointed on behalf of the UK Department for International Development (DfID) to carry out this survey of 'green growth / environmental sustainability accounting and indicators'.

2.1 Objectives and purpose

The objective of this work was:

"To summarise and provide an understanding of the pros and cons of a range of accounting and indicators frameworks relevant to monitoring sustainable/green growth and development, including wellbeing (subjective and objective) accounting."

The purpose being to:

"…inform the UK's policy position on what accounting framework it might support, and what indicators could best track (whether or not accounting is taking place) progress and results along a green/sustainable path, including testing whether these results can also be correlated with growth and poverty reduction."

2.2 Approach and definitions

The approach to this was based on a quick, focused literature scan of the main indicators in this area with the intention to:

- Outline the key features of relevant frameworks / indicators;
- Set-out (if possible) the extent to which the frameworks / indicators have been applied;
- Identify strengths and weaknesses of the frameworks / indicators;
- Identify any gaps in the frameworks / indicators; and
- Provide initial answers to a series of questions related to the relevance, quality, cost and appropriateness of the frameworks / indicators.

The major distinction to be made in considering the indicators was between category 1 (directly relevant) and category 2 (indirectly relevant), defined in the terms of reference as follows:

- **Category 1: directly relevant frameworks/indicators** – e.g. the System of Environmental-Economic Accounts (SEEA), Wealth Accounting and Valuation of Ecosystems Services (managed by the World Bank), work on environmental footprints (e.g. by the Global Footprint Network), OECD green growth indicators, UNEP sectoral indicators, etc.

- **Category 2: indirectly relevant frameworks/indicators** – e.g. wellbeing and poverty indicators such as the Multidimensional Poverty Index (MPI), Millennium Development Goals (MDGs), the OECD Better Life Index, Indices of Social Development (ISS), Human Development Index (HDI), the Sustainable Society Index, or gender related indices such as the OECD Social Institutions and Gender Index (SIGI) and the Gender Equity Index (GEI), etc.

3 Accounting frameworks and indicators for green growth / sustainability

3.1 What is green growth?

Green growth is an emerging field, its relatively new status meaning that a consistent definition, as exists for sustainable development, is not yet available. Definitions do exist, with five of the major definitions profiled in the terms of reference for this study, including the latest UK definition, presented below:

- "resource efficient, low-carbon, climate-resilient & socially-inclusive growth" (UNEP)
- "fostering economic growth and development while ensuring that natural assets continue to provide ecosystem services on which our well-being relies. It is also about fostering investment, competition and innovation which will underpin sustained growth and give rise to new economic opportunities." (OECD)
- "a strategy for promoting economic growth with the goal of adding an ecological quality to existing economic processes and creating additional jobs and income opportunities with a minimal environmental burden. This primarily means seeking a relative or absolute decoupling of economic growth and environmental degradation, depending on the local context. It also means taking into account the risks involved with future changes in the environment, e.g. by adapting to climate change and international obligations within the framework of an environmentally qualitative policy." (World Bank)
- "a new model of economic growth that reconfigures business and infrastructure to build on the value of natural capital, climate resilience, and reduce exposure to liabilities associated with carbon-intensive development pathways and unsustainable resource consumption." (PwC)
- "A green economy will maximise value and growth across the whole economy, while managing natural assets sustainably" (UK: Defra, DECC and BIS[2])

These definitions have many commonalities and a few points of divergence. Among the common points are:
- Underlying acceptance of the need for economic growth.
- A clear recognition of the link between economic development and the environment and a need to develop more sustainably, to reduce degradation of natural capital. Only the UNEP definition does not directly refer to this.
- Environmental resilience being crucial, particularly in light of the challenge of climate-change. Although, for the OECD and the UK definitions this is less visible.

More diverging features are:
- The extent to which the focus is on the economic opportunity from green growth – this appears much stronger in the OECD and World Bank definitions than for UNEP or PwC.
- The role of the social dimension – only UNEP explicitly refer to socially-inclusive growth, although the World Bank and OECD indirectly refer to social factors such as employment, income growth and access to sanitation.

---

[2]   HM GOV (2011) Enabling the Transition to a Green Economy: Government and business working together

3.2 Profiles of directly relevant frameworks / indicators

This section presents a short description and assessment of the major frameworks / indicators identified as directly relevant to green growth under category 1 (as defined in section 2.2).

### 3.2.1 The System of Environmental-Economic Accounts (SEEA)

SEEA is a UN-led framework for environmental economic accounting. The first version was released in 1993 by the United Nations following on from the discussions stimulated by the Brundtland Report in 1987[3] and the Rio Earth summit in 1992. The driving idea behind it related to better understanding and more systematically considering the value of the environment to make decision making more sustainable. During the development process experts from large international organizations, national statistic offices, universities, and consultants were involved. In 2003, a further version was released and at the "Beyond GDP" conference in November 2007 the importance of a international accounting system was emphasized. SEEA was adopted as a initial statistical standard at the 43rd session of the Statistical Commission in March 2012.[4]

The current SEEA framework

The framework itself is based on an adaptation and expansion of the existing internationally agreed system of national accounts (SNA). The main benefits derive from the ability to analyse economic and environmental data within a common framework. This provides insight into the impact of the economy on the environment and the importance of the environment for the economy. Bringing data together for environmental economic accounts creates the ability to produce broad aggregate indicators to summarise the economic/environmental situation in a nation, the ability to produce more detailed analysis of specific issues within this and the national and international comparability and consistency. This can make the SEEA accounts a crucial tool to improve understanding for policy makers to make more informed decisions.

As it has existed since 2003 the SEEA focuses on specific sub-systems of the environment including energy, water, fisheries, land and ecosystems and agriculture. Energy and Water are the most advanced sub-systems in terms of being operationalized, with the latter having an interim international statistical standard.

The existing SEEA framework is integrated with the System of National Accounts (SNA) and represents an expansion of these. It involves the preparation of physical accounts, hybrid accounts which link physical and monetary flows, and two forms of monetary accounts which allow differing degrees of variation from the SNA framework. The accounts look specifically at environmental degradation, depletion and defensive expenditure. The SEEA framework brings together and accounts economic and environmental stocks and flows – physical and monetary (as described in the figure). It has also been designed to be somewhat modular, so that nations can adopt the SEEA framework to their accounts in parts, consistent with their priorities and resources.

---
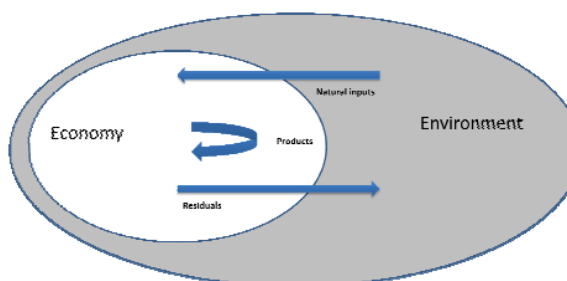
3   UN WCED (1987) Our Common Future
4   Documents for the forty-third session of the Statistical Commission New York, 28 February to 2 March 2012, UN.

The SEEA framework has helped develop methodologies and move towards international agreements on the process[5]. Various countries have used the SEEA guidelines to help develop national environmental economic accounting reports and systems. These include Australia, Austria, Botswana, Brazil, Canada, China, Denmark, Finland, France, Germany, Indonesia, Italy, Japan, Korea, Mexico, Mongolia, Namibia, the Netherlands, Norway, the Philippines, Spain, Sweden, Thailand, UK and the USA. In doing so no single country has implemented all components included in the SEEA though many have adopted various aspects of the SEEA that address country-specific public policy, sustainability accounting and reporting needs (Korea, Japan, USA, Germany, Philippines, Mexico).

SEEA Central Framework revision

The current revision to the SEEA will bring different aspects together and improve and expand the framework methodologies. It will have 3 parts, the:

1. **Central Framework**, which will be the main part and represent an internationally agreed standard for environmental accounting. The revision of the central framework has recently been approved.
2. **Experimental Ecosystem Accounts**, will extend work into ecosystem accounting.
3. **Extensions and Applications,** will provide further data and analytical advice for users.

The SEEA revision will continue, in most respects, to use the same standards and rules as the SNA, although there are some differences to reflect the greater environmental focus. Among the key issues in the revised SEEA is the way in which unsustainable extraction (depletion) is defined, understood and measured. Monetisation of environmental assets remains an important issue, as these are often not traded and therefore have no market value, this can be problematic. Sub-soil assets are among the main assets discussed in relation to this. The largest part of the SEEA framework continues to focus the methodology on these issues, to record unsustainable depletion of natural resources as a cost in national accounts.

The **revised central framework** is structured around 3 components, the:

1. Physical flows of materials and energy within the economy and between the economy and the environment;
2. Stocks of environmental assets and changes in these stocks; and
3. Economic activity and transactions related to the environment (including spending on natural resource management and protection).

A clear distinction is drawn between the economy and the environment, for their stocks and flows, this distinction is based on the 'production boundary', i.e. that (human) produced goods and services are economic, while the environment is the biophysical environment, living and non-living. The two interact physically within the SEEA (as shown in the previous figure) as the environment provides natural resource inputs to the economy, the economy produces products that remain within the economy, but also residuals that flow back into the environment. Consideration in these terms focuses only on the productive value of the environment to the economy, not the non-productive benefits such as water purification and other ecosystem services. These other benefits and services will be picked up in the experimental ecosystem accounts. The SEEA framework also allows for specific monetary flows within the economy of relevance to the environment, e.g. environmental taxes and protection expenditures, to be measured. These are of interest to pick out the specific focus and interest of a country in environmental issues and can be linked to changes in environmental capital to measure effectiveness. In practical terms this enables the identification of

---

[5]   It is the purpose of this section to focus more clearly on the recently agreed revisions to the SEEA, but the 2003 SEEA guide can be found here: http://unstats.un.org/unsd/envaccounting/seea2003.pdf

countries with high environmental taxes, subsidies and / or expenditure, and those with larger environmental goods and services sectors. Taxes and subsidies are netted off against each other in the calculations.

Environmental stocks and flows are valued at their net present value (NPV), with specific guidance provided in the SEEA for how this should be done per resource/asset, so far for energy and material resources, forest resources, air and water, although water valuation issues have not yet been resolved and are therefore not covered within the central framework.

The SEEA outlines that in an ideal case, the sources of the market prices should be the values observed in markets in which assets are regular, homogeneous and traded in considerable volume. If this is not the case, the discounted value of future returns (NPV) approach should be used, projecting the future rates of extraction of the assets together with projections of its price to generate a time series of expected returns. Key aspects in this approach are the measurement of returns on environmental assets, the determination of the expected pattern of resource rents based on expected extraction profiles and prices, the estimation of the asset life, the selection of a rate of return on produced assets and the choice of discount rate.

In the SEEA returns are estimated by the stream of resource rents - derived from standard SNA measures of gross operating surplus (GOS) - that are expected to be earned in the future and then discounting these. As these are heavily influenced by institutional arrangements the residual value method should be used and, where possible, reconciled with estimates obtained using other methods.

Specifically, the determination of the expected patterns of resource value should be based on current estimates of resource rents including a realistic rate of resource extraction and considering the general level of inflation. The estimation of the asset life can, in simple cases, be calculated by dividing the closing stock by the excess of expected annual extractions over expected annual growth.

The selection of a rate of return on produced assets can be calculated in two ways, endogenous and an exogenous. The latter is recommended in SEEA: Thus the expected rate of return on produced assets is equal to an external rate of return, which should be based on industry and country specific norms. Where information for these do not exist, average rate of return proxies, i.e. bond rates, should be used, the important factor is that a real rate of return is used.

According to the SEEA the choice of a discount rate is a combination of market-based discount rates and the assumed rate of return on produced assets in combination with the use of social discount rates. Furthermore, they point out that in situ prices must be used, instead of the unit resource rent to value the stock of resources. The same applies to the valuation of all changes in the stock of a resource. The SEEA annex 5.2 discusses discount rates in more detail and the factors that should be taken into account in their selection but does not recommend or prescribe specific rates to be used.

Summary of calculation of NPV in SEEA framework, p. 191
1. Estimates of GOS, specific subsidies and taxes on extraction of produced assets for the activity are obtained from relevant sources, most likely based on national accounts data, relevant activity specific information and assumptions regarding rates of return on produced assets.
2. Estimate Resource rent as GOS less Specific subsidies plus Specific taxes less User cost of produced assets.
3. Estimate the asset life based on physical assessment of the stock and projected rates of extraction and growth.
4. Project the estimate of Resource rent over the life of the asset taking into account any expected changes in extraction pattern.
5. Apply the NPV formula using an appropriate discount rate

One of the big advantages of this NPV approach is the fact that both non-renewable and renewable natural resources can be addressed within the same accounting framework.

The framework operates through physical and monetary supply and use accounts, asset accounts, economic accounts and functional accounts. These are underpinned by the assumption of constant mass and energy, so supply and use must balance, i.e. it must come from somewhere and go somewhere in the accounts. The following figure (from the SEEA) summarises the interaction between physical, monetary and asset accounts. The data sources for monetary economic accounts are consistent with the SNA data gathering infrastructure, including trade figures and business surveys. The physical accounts are populated from physical supply and use tables (PSUT), which draw from a variety of environmental data sources, i.e. river flow data for water, energy use data for fuel resources and emissions to air. Aligning physical data with monetary data is one of the main statistical challenges in preparing these accounts.

		Industries	Household	Government	Rest of the world	ASSET ACCOUNTS (Physical & Monetary terms)	
						Produced assets	Environmental assets
						Opening stock	
MONETARY SUPPLY AND USE TABLE	Product - supply	Output			Imports		
	Product - use	Intermediate consumption	Household final consumption expenditure	Government final consumption expenditure	Exports	Gross Capital Formation	
PHYSICAL SUPPLY AND USE TABLE	Natural inputs – supply						Extracted natural resources
	Natural inputs – use	Inputs of natural resources					
	Product - supply	Output			Imports		
	Product - use	Intermediate consumption	Household final consumption		Exports	Gross Capital Formation	
	Residuals - supply	Residuals generated by industry	Residuals generated by household final consumption			Residuals from scrapping and demolition of produced assets Emissions from controlled landfills	
	Residuals - use	Collection & treatment of waste and other residuals				Accumulation of waste in controlled landfills	Residuals flowing to the environment **
						Other changes in volume of assets (e.g. natural growth, discoveries, catastrophic losses)	
						Revaluations	
						Closing stock	

* Note: Grey cells are null by definition. Blank cells may contain relevant flows. These flows are articulated in detail in Chapter 3.
** While these residual flows (for example, air emissions) are not flows of environmental assets they may affect the capacity of environmental assets to deliver benefits. The changing capacity of environmental assets may also be reflected in other changes in the volume of assets.

Economic accounts are only produced on a monetary basis, as some economic activities have no balancing physical equivalent. Balancing factors, as used in the SNA, are also used, including value added and depletion of fixed capital.

Functional accounts are used to supplement the whole account system, allowing for specific analysis to be carried out on a particular environmental aspect.

The outputs from all of these accounts can be compiled into a combined format to present the overall balance and relevant indicators calculated or drawn from this summary. The extensions and applications module of the SEEA revisions will further develop this aspect.

The development of the **SEEA experimental ecosystem accounts** is being led by the UNSD, the European Environment Agency (EEA) and the World Bank WAVES partnership (see 3.2.3). This remains a work in progress with no consultation drafts yet published but some important information is available. That the approach will try to build upon the Millennium Ecosystem Assessment and The Economics of Ecosystems and Biodiversity (TEEB – see 3.2.7), but it also envisages a move towards a new Common International Classification for Ecosystem Services (CICES)[6].

Critique

A number of issues can be identified in the SEEA central framework and wider approach[7], these include:

1. **Problems in environmental resource valuation** – as this involves a level of judgement, assessment or modelling that moves beyond the standard accounting framework of the SNA. This is a crucial issue across every indicator.
2. **Accounting environmental stocks and flows does not equal sustainability** - the SEEA approach only charges the depletion of the environment and does not consider overconsumption or underinvestment. Sustainability is not specifically characterised like it is in the adjusted net savings or the ecological footprint approaches (see following sections).
3. **Discussion on treatment of resource rents -** there is also a lack of agreement on whether resource rents influence the stock of resources (decline) or income (increase). It is understood that a position in between these two is preferred. Connected to this is the discussion of if an increase in value of a resource stock due to natural growth can be regarded as income and therefore be offset against a charge on income for the use of resources or not, i.e. could an increase in the stock of timber resources be used to compensate for depletion of that resource,
4. **Challenges in accounting for non-renewable resources -** the treatment of mineral deposits is controversial, due to the fact that they are not renewable on a human time scale and therefore will automatically count as environmental depletion if accounted in this way. This locks any kind of consumption of these resources into a context of environmental cost, which is a hard interpretation and controversial politically. Proposed solutions to this issue include either the deduction of extraction from the net operating surplus, or the consideration of mineral deposits as a result of production and that their value should then be incorporated to both mineral exploration and the mineral deposit. In this context the treatment of undiscovered reserves is particularly problematic, in how this is accounted in the total asset stock. Should these be estimated now and then data corrections applied? i.e. that accounts more clearly and directly show depletion, or should newly discovered reserves simply be added to the total. The view on this issue often varying by a nations potential for undiscovered reserves.

---

6   UNSD – London Group (2011) SEEA experimental ecosystem accounts: a proposed outline, roadmap and issues.
7   Stiglitz, Sen and Fitoussi (2009) Report by the Commission on the Measurement of Economic Performance and Social Progress

5. **Accounts do not record quality** - while more of a challenge for ecosystem accounts this is also relevant to areas under the central framework such as water and forests.
6. **Production boundaries** - the definition of the production boundary can be inherently unsatisfactory in some respects and lead to some sectors and assets being included in the account, while others are excluded, e.g. managed landfill waste treated as being part of the economy, whilst unmanaged sites are part of the environment;
7. **Spatial and temporal issues** – the link to SNA means sub-national (spatial) and sub-annual (temporal) environmental issues are not handled well within the framework;
8. **Alignment of SNA with environmental sectors and assets** – the use of SNA standards are not always entirely relevant from an environmental perspective (e.g. the ISIC industrial classifications do not always align with environmental sectors and assets)

In comparison to the approaches presented below it is important to emphasise that the SEEA is a data system. It provides a framework within which economic and environmental data can be structured and presented and a standardised international methodology for their production. While indicators and ratios can be derived or generated from the system, the SEEA does not specifically 'advocate' any. At the same time many of the indicators subsequently referred to can be, or are, derived from the data prepared and used in the SNA and SEEA. For these reasons, and despite the critique delivered above, the SEEA and associated methodologies are the international data standard for environmental accounting and the great majority of subsequent indicators take their lead from it or seek alignment with it.

3.2.2   Adjusted Net Savings - Wealth of Nations (World Bank)

The World Bank's first attempt to deal with environmental accounting (EA) was during the early 1990's, when they conducted a review that provided an overview of countries which compile environmental data. The purpose was to better understand what wealth was, what were the components in it and how understanding this could improve the World Banks development agenda. In 2006 they published their first major report "Where Is the Wealth of Nations?", which was the first document of a series of publications with the overall topic 'Environment and Development'.

The Wealth of Nations work by the World Bank was developed to analyse the key role of the management of wealth through saving and investments and to show the importance of human capital and good governance. The aim was to encourage countries in developing a comprehensive agenda of their natural resources and incorporate these in the national policy strategy. During this time it also became clear, that GDP is not a holistic measure of the true wealth of nations, especially in developing countries

The three main questions in this context are:
1. "Do changes in wealth matter for the generation of well-being?"
2. "What are the key assets in the generation of well-being?"
3. "How can comprehensive wealth and its changes be measured in national accounts?"

This has been most specifically developed in the context of developing countries and particularly resource-dependent countries.

The Wealth of Nations approach is based on stock (total or comprehensive wealth) and flow (adjusted or genuine net saving) accounting. A nations stock of total wealth is constructed from 3 elements, produced capital, natural capital and the net present value of consumption possible from the total capital in the next 25 years. The difference between the sum of produced and natural

capital and total wealth is referred to as intangible capital. Produced capital is buildings, machines and infrastructure, natural capital is cropland, pastureland, forests, minerals and energy and intangible capital includes human capital and quality of institutions. The combination of these is demonstrated by the figure below.

Figure 2.1 Estimating the Components of Wealth
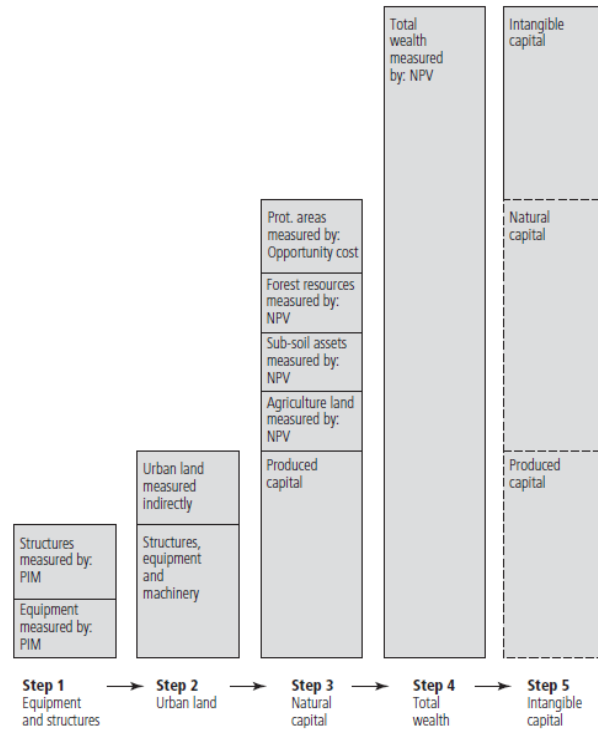
The specific calculations of total wealth are underpinned by various assumptions, such as the 25 year period, longevity of physical capital and discount rates for NPV.

In this approach the total comprehensive wealth is measured as the sum of different capital stocks and on-going flows, measured by Adjusted Net Savings (ANS – defined on next page). From the value of an initial stock the approach is used to calculate the annual changes to estimate the value of physical capital. Total wealth and natural capital are derived from NPVs of the incomes that the stock is able to produce in a 25 years time period, or by estimating the future consumption based on actual figures and summing consumption over the next 25 years. As a last step the PV of current consumption is taken. $W_t = \int_t^\infty C(t) \cdot e^{-\rho(s-t)} ds$

This method of calculation is underpinned by three assumptions. The first is the discount rate used in the model. The discount rate (r) equals the pure rate of time preference (p) plus the product of the elasticity of the marginal rate of consumption (μ) and the growth rate of consumption (g). These are assumed respectively at p=1.5%, μ=1%, g=2.5%, together totalling a 4% discount rate assumption. This contrasts with the SEEA approach as it sets a specific rate, whereas SEEA refers to applying rates relevant to the specific national and/or asset context. The second assumption is for sustainable growth of consumption in the future this implies above all that the level of saving is equal to the depletion of other capital stocks, i.e. that the calculation is balanced. Sustainability in this sense is weak and questions have been raised on the applicability of 2 or 2.5% growth rate in consumption, particularly in a developed country context. The third assumption relates to the

assumption of a 25 year lifetime for assets, with questions on whether discount rates should vary over this lifetime and whether 25 years is appropriate for some resources with much longer lifetimes, i.e. forests, mineral resources.

Applying this approach to physical capital is relatively straight-forward and makes use of data from national accounts. Natural capital is trickier and different methods are used across the 6 defined sub-categories:

1. **Energy and mineral resources:** is calculated by economically viable reserves at that point in time, which is a factor of technology and prices.
2. **Timber forest resources:** are calculated from FAO data on roundwood production and rents.
3. **Non-timber forest resources:** is calculated at 10% of total forest area, valued at USD 27 per hectare.
4. **Crop land:** is calculated from the total value of production plus a 30% rent value applied to all crop land.
5. **Pasture land:** is calculated from the total value of production plus a 45% rent value as a proportion of production.
6. **Protected areas:** value is calculated from opportunity cost equal to the lowest values for crop and pasture land in that country.

Changes in the total wealth over time are calculated on the basis of the changes (flow) in these stocks, using adjusted net savings. The formula for this is outlined below

Adjusted net savings (ANS) = aNNI – [Consumption] + [Foreign transfers] + [Education expenditures]
Where:
a**NNI =Adjusted net national income** = NNI –[Depreciation of natural capital]
NNI =Net national income = GDP + [Net foreign factor income] – [Depreciation of fixed capital]

This measures net national saving, less consumption, government expenditure, exports and imports and depreciation of produced assets. Expenditure on education is included as an investment in capital and consumption of resources above their natural replacement rate is subtracted as depreciation of natural capital. Pollution costs are also depreciated in this way. The figure below presents this process step-by-step for Uzbekistan in 2008.

World Bank 2010.
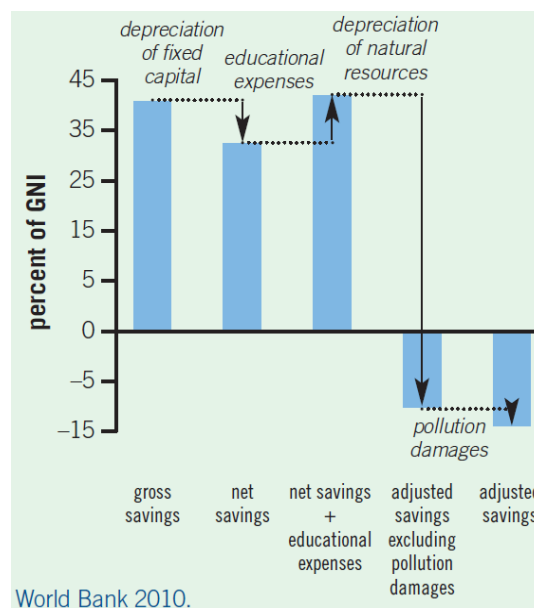
The outcome ANS figure gives a view of net changes in total wealth, i.e. if more resources are consumed than are invested in education or capital, or if pollution costs are higher than investments, then total wealth will be reduced. This is a useful way to analyse the extent to which developing economies are using their income from produced and natural capital to invest sustainably to increase total wealth over time as it stresses the importance of natural capital. Taking this approach raises the same issue as identified under point 3 of the critique of SEEA on how resource rents are accounted and the problems of 'offsetting' each other when aggregated,

When resource depletion and population growth are both taken into account, the majority of low income countries face declines in wealth per capita. Therefore the composition of wealth indicates the 'initial conditions' for development and the change in real wealth ('genuine' or 'adjusted net' saving) is a measure of sustainable development.

At the moment, the World Bank provides data of "wealth accounts" for over 150 countries for 1995, 2000 and 2005[8].

The use of depreciation, or depletion, of fixed capital and natural resources is consistent with the SEEA approach which also accounts for the same flow adjustments to economic and environmental stocks, but framing it in a savings/investment context moves it towards being more a measure of sustainability.

The **adjusted Net National Income (aNNI),** referred to above as a component of ANS, can also offer an indication of total wealth and green growth, it is closer to a measure of green GDP than an environmental sustainability indicator. This is simpler than ANS in that it modifies GDP by including net foreign factor income and depreciating fixed and natural capital. This makes it simpler to calculate, basically constituting an adjusted aggregate from the SNA, and also to relate to official GDP figures. aNNI is reported in the World Bank Little Green Book. aNNI was primarily developed for developing countries with significant natural resource endowments.

The Little Green Data Book has been published annually since 2003, latest report in 2011[9], The information is provided for most countries and is also grouped on a regional and socio-economic basis. The data covers GNI, aNNI and associated data on agriculture, forests and biodiversity, energy, emissions and pollution, water and sanitation, environment and health and aggregate savings, depletion and degradation rates.

Critique

A critique of the World Bank approach by Thiry and Cassiers[10], while highlighting it has advantages over GDP as a measure, also points to a number of issues with how it formulates wealth and calculates sustainability, these include the following key points:

1. **Substitutability of capital** – that changes in one type of capital can be offset, by investment and growth in another, softens the ecological sustainability of the measure, i.e. declining natural capital could be offset by investment in produced capital and denoted as sustainable by these measures, whereas from an environmental perspective the reverse could be true.

---

[8]   World Bank data: time series of ANS 1980-2008
      http://siteresources.worldbank.org/EXTEEI/Resources/ANS_time_series_by_country_1970to2008.xls
[9]   World Bank (2011) Little Green Book available at: http://data.worldbank.org/products/data-books/little-data-book/little-green-data-book
[10] G. Thiry and I. Cassiers (2010) Alternative Indicators to GDP: Values behind Numbers Adjusted Net Savings in Question

2. **Social wealth not included** - the focus on production gives a narrow economic view of human capital and wealth, ignoring social wealth such as trust, respect, altruism, institutions and culture.

3. **Investment does not automatically equal outcome** – including education expenditure as an investment that improves human capital does not account for the actual outcomes of the education system. This leads into the wider issue of quality, which many of the indicators are unable to accommodate at this point. It is specifically interesting here, given the positive effect assumed from investment.

4. **Problems in natural resource valuation –** an issue across almost all measures is also present for this indicator, in how can monetary or market values properly capture the value of a natural resource.

5. **Focus on producers not consumers –** the framework runs down (penalises) the capital of countries that produce and export their natural resources, rather than that of the countries that actually consume the resources. This is relevant to the production-consumption debate and attribution of causes of unsustainable economic growth, this is reviewed in more detail in section 3.2.4,

6. **Assumption for production and growth –** is implicit in the calculation, the authors believe this locks it into a productivist view of growth, inconsistent with finite resources and alternative economic solutions. By assuming a 2.5% 'sustainable' growth rate of consumption the approach locks in this growth, some would argue that this is inherently unsustainable, i.e. exponential growth is impossible in a finite world.

7. **Some unrealistic assumptions –** of consumption growth, discount rates and asset lifetimes. Each of these can be questioned, although their choice is based on logic and evidence they are unlikely to be accurate generally.

Many of these critique points were also made in the Stiglitz report[11]. Some of the same critiques could also be applied to the SEEA methodology, particularly no.2, although the SEEA doesn't propose to address social issues. The SEEA does attempt to tackle issues such as in point 4 of the critique here. The tension between the production and consumption perspective is clear in both, this is tied to the production perspective of GDP and the underpinning SNA framework.

3.2.3 WAVES - Wealth Accounting and Valuation of Ecosystems Services

WAVES is a partnership programme managed via the World Bank but funded by a handful of donor countries – including the UK through DfID. The idea partly emerged from the Bank's Environment Strategy consultations and the question of how to convince governments and ministers to consider sustainable aspects in their planning and management. This was further catalysed at the UN Biodiversity summit in Nagoya, Japan in 2011, where a desire to move The Economics of Ecosystems and Biodiversity (TEEB – see section 3.2.7) theory and research into policy and implementation was articulated. As a result the WAVES programme was developed to pilot the implementation of "green" national income accounts

The WAVES programme is not an accounting framework/indicator itself, but rather a means to promote and implement natural capital accounting in selected pilot developing countries. Among its wider aims is raising the awareness of sustainable development and bringing the valuation of natural capital into the highest level of a country's economic decision-making. This will form part of discussions on natural capital / ecosystem accounting at the Rio +20 conference in 2012.

---

[11]   Stiglitz, Sen and Fitoussi (2009) Report by the Commission on the Measurement of Economic Performance and Social Progress

The WAVES programme itself aims to be implemented in 5 countries, in partnership with the national authorities, the selected countries are Botswana, Colombia, Costa Rica, Madagascar and the Philippines. These have all conducted previous work on environmental accounting, so that there is a base of knowledge and capacity to work from. Other countries may also join at a later date, India among those that are interested.

The methodology for WAVES has will focus on implementing SEEA-based environmental accounting. The approach will vary by country in the environmental and assets, aspects and resources it considers. Ecosystems will be considered explicitly in Colombia, based on a TEEB framework. To some extent the WAVES programme can be seen as a trial of the SEEA Experimental Ecosystem accounts framework. Potential links to the World Bank ANS approach are also possible given the role of the World Bank.

As the WAVES programme remains primarily at a pre-implementation stage it is hard to conclude the eventual methodologies that will be deployed. The intention of these countries as pilots and trials suggests that a variety of approaches are possible and that the results will be informative for developing wider standards in future.

3.2.4 Ecological Footprint – Global Footprint Network

The Global Footprint Network (GFN) is a non-profit organization established in 2003 to create a sustainable future. They use the Ecological Footprint (EF) to measure how much land and water area a human population requires to produce the resources it consumes and to absorb its carbon dioxide emissions. The Network includes many different partners including academic institutions, consultancies, corporations, NGOs and government organizations.

The Ecological Footprint concept was created by Mathis Wackernagel and William Rees at the University of British Columbia in the early 1990's[12]. They aimed to establish a type of environmental account, in which human demands on the biosphere and the biosphere's ability to meet those specific demands are calculated. The EF does this through a measure of area – a representative global hectare of bioproduction.

To calculate the area necessary for a certain activity they currently use yields of primary products (from cropland, forest, grazing land and fisheries) and compare them with the amount of biologically productive land and sea area available to provide the resources. In 2009 the Ecological Footprint Standards were established to guarantee a progressive and stable assessment of the data and ensure the comparison of the results.

At a national level the footprint provides two primary figures to interpret sustainability. An assessment of bio-capacity measured in average global hectares, which represents a baseline of what a nation can supply from its own natural resources, and a national footprint which represents the number of global hectares required to satisfy the consumption within the country. This

The Ecological Footprint
MEASURES
how fast we consume resources and generate waste

Energy   Settlement   Timber & paper   Food & fibre   Seafood

COMPARED TO
how fast nature can absorb our waste and generate new resources

Carbon Footprint   Built-up land   Forest   Cropland & pasture   Fisheries

---
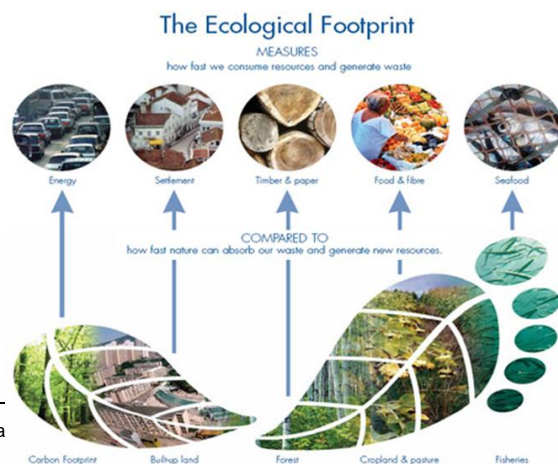
[12] Wackernagel, M. and W.E. Rees. 1996. Our Ecologica
        Canada: New Society Publishers.

second element is interesting and important as it represents an underlying consumption-based approach to measuring sustainability, whereas the other indicators and frameworks reviewed in this paper take a much more production-based approach.

Assessments are available for 241 countries, territories and regions with more than 5 000 data points, with footprints for some calculated back to 1961. The national footprint calculation[13] is mainly based on international data sets published by the Food and Agriculture Organization of the United Nations, the International Energy Agency, the UN Statistics Division, the Intergovernmental Panel on Climate Change and also several scientific articles [14]. In this sense there is cross-over with the data used by the World Bank in its ANS approach, and possibly with the SEEA framework, through use of FAO data for calculating changes in natural capital.

The footprints show that the majority of nations have an ecological footprint that exceeds their biocapacity. Globally, the ecological footprint is estimated to have exceeded biocapacity since around 1975 and the trend is towards an increasing footprint and decreasing biocapacity as natural capital is expended.

Among the strengths of the ecological footprint is its simplicity in terms of communication, how it frames the consumption within environmental/ecological limits and the strong stakeholder network that has coalesced around it. This indicator shares with accounting approaches the idea of one common measurement unit, in this case the global hectare. The ecological limits contrast with the World Bank approach where savings and investments can increase natural capital, it also avoids the issue of investments in other forms capital being able to balance towards 'sustainability', i.e. a footprint lower than biocapacity, does not assume increases in biocapacity (savings).

The Footprint has built links with other organisations such as UNEP to frame it in terms of human development, i.e. plotting the EF against Human Development Index (HDI) scores, to examine how countries can be developed and sustainable (see 3.2.6 for more).

Critique

There have been a number of independent reviews of the footprint methodology, some of which picked out individual points of uncertainty but found value and logic to what the footprint is trying to do[15]. A variety of specific criticisms have been levelled at the footprint[16] [17] [18], many revolving around the complexity and lack of transparency of some aspects of the methodology which makes a variety of assumptions on yields, growth rates and impacts.

Among the largest criticisms are the following:
1. **Productive focus and potential substitutability of land types** – is assumed across the different categories of natural capital. This is can lead to contradictions in sustainability terms, for example as intensely farmed agricultural land could be judged to have a higher biocapacity than land with ancient forest, due to the measures looking at the capacity (net primary

---

13   The methodology is explained in more detail on the GFN website, specifically here http://www.footprintnetwork.org/images/uploads/National_Footprint_Accounts_Method_Paper_2010.pdf and http://www.footprintnetwork.org/en/index.php/GFN/page/ecological_footprint_atlas_2010
14   An overview of all the data sources used in the Ecological Footprint Atlas 2010 is listed under http://www.footprintnetwork.org/en/index.php/GFN/page/ecological_footprint_atlas_2010.
15   www.footprintnetwork.org/reviews
16   EC (2008) Potential of the Ecological Footprint for monitoring environmental impacts from natural resource use
17   Stiglitz, Sen and Fitoussi (2009) Report by the Commission on the Measurement of Economic Performance and Social Progress
18   T. Wiedmann and J. Barrett (2010) A Review of the Ecological Footprint Indicator—Perceptions and Methods; Sustainability 2010, 2, 1645-1693

productivity) of the biome to supply human economic needs, rather than its ability to support biodiversity or other non-productive functions.

2. **Differentiation between energy technologies** – the methodology to assess carbon impacts from energy generation, while presenting impacts in terms of the equivalent area of biomass required to offset the emissions, and giving an idea of the scale of impacts, has faced criticism for being too simplistic between technologies.

3. **Limited scope** – the footprint does not take into account environmental impacts where no natural regenerative capacity exists, such as waste generation, eutrophication and pollution. Although data on these elements is also missing from national accounts and is, in general, quite limited. This can be understood in the context that it is unlikely to be possible for any single indicator to provide a complete and robust idea of performance with respect to ecological limits, given the data and other limitations that apply.

4. **Bias towards large, sparsely populated countries** – as a measure it will be evident that larger and/or less populated countries, even with similar income levels, will 'perform' better in footprint measures as they will have higher biocapacity relative to lower footprints, e.g. Sierra Leone vs Congo, or the Netherlands vs Finland. While useful and realistic as a measure of 'what you have' v 'what you use' it is felt to discriminate.

5. **Need and effects of trade not well incorporated** – related to the last point the EF is felt to conflict with the need for international trade through an implied suggestion towards 'autarky', i.e. only using what you can produce yourselves. Yet in these terms the EF is simply a measure, much as monetary trade balances, interpretation is left to others. The potential interpretations have led to suggestions that it is perhaps better to focus only on a global footprint rather than national footprints. This is related to how domestic biocapactity can be used for exports and how imports can also be used to meet its needs.

6. **Limited policy relevance** – although a strong communication measure, the footprint is assessed to have limited wider relevance to policy and decision makers.

Related to this final point it was suggested by the Stiglitz report that the Ecological Footprint could best be used as an indicator of non-sustainability at the worldwide level, but that less-encompassing but more rigorously defined footprints, such as the carbon footprint (CF) – which is part of the EF – are better suited to national level use/application. It was concluded that the footprint may be better suited to be one indicator within a wider framework for assessing sustainability and that it may also be better to restrict its scope solely to carbon, and at the global, rather than national, level, and covering the other aspects within the EF, such as resource use, via other indicators.

Proposals have been made to link the national footprint accounts produced by GFN to the SEEA framework[19]. The benefits to the EF stem from consistency in methodologies with the SEEA framework and being able to utilise more timely SNA data to calculate production and consumption footprints. Due to the fact the two measurements use different codes of classification, it is necessary to create comprehensive bridge tables to harmonize the outcomes, e.g. the GFN proposed a potential bridge table for this to convert the 14 land types defined in the SEEA into the 5 types in the EF. The two also differ in the way that they 'use' land, the EF valuing the productive bio-capacity of land towards a national aggregate, while the SEEA focuses on the actual production of the land, stocks and flows, putting monetary (in addition to physical) values to them. There is overlap in the way that both monitor the physical stocks and flows of land, i.e. land cover types and changes in land cover (use).

---

[19]   UNCEEA (2010) Harmonizing the national footprint accounts with the SEEA

The need to better incorporate international trade in EF calculation provides further possibilities for linkages. One possibility could be the combination of the EF, as a consumption based approach providing an insight into the sustainability of domestic consumption in terms of land and biocapacity, and the SEEA providing a way to value in monetary terms the productive value of land.

Consumption and Production perspectives

The EF could be described as a pure consumption-based approach, this is in contrast to the other measures reviewed here which are, like GDP, primarily production based. This contrast in approaches is important, particularly in an international development and sustainability context.

Perhaps the simplest example of the difference between the approaches is a comparison of the EU and China, in the last 10-20 years the environmental impact of the EU has been shown to decrease in most respects, evidencing a decoupling of economic growth from environmental impact[20]. Over the same period China has experienced rapid economic growth, but alongside this also rapid growth in its environmental impact, for example becoming the worlds largest GHG emitter. It is clear that a large part of Chinese production is consumed in Europe and other developed countries, yet the environmental impact is attributed to China, not Europe. This begs the question, and it has been posed by China in international climate negotiations, would it not be fairer to attribute the environmental impact to consumer countries rather than producers, as it is the demand for consumption which leads to the impact. Taking this perspective would have important implications to the relative sustainability of an economy and has been a subject of discussion.

The advantages and disadvantages of these approaches in the context of green growth were discussed in the Stiglitz report and can be summarised as in the table below. It concludes that a move towards consumption-based measures can offer a more rounded measure of a nations actual economic wellbeing but identified the need to balance or complement this with measures relating to equity and sustainability of consumption.

	+ Pros	- Cons
Production	• Easier to aggregate quantities of a very different nature; • Captures all final goods in the economy;	• Reflects poorly on resource producing countries in environmental accounts; • Production can expand while income decreases or vice versa; • Prices often do not exist for some goods and services; • Prices may deviate from society's underlying valuation; • Profits that are repatriated by foreign investors show up in GDP but they do not enhance the spending power of the country's citizens; • Prices of imports evolve very differently from the prices of exports;
Consumption	• More closely connected to well-being and material living standards of citizens; • Consumption over time can be seen as wealth;	• Average income/consumption could be unequally shared across groups (Median consumption as an improvement) • Consumption goods can increase current well-being at the expense of the future

---

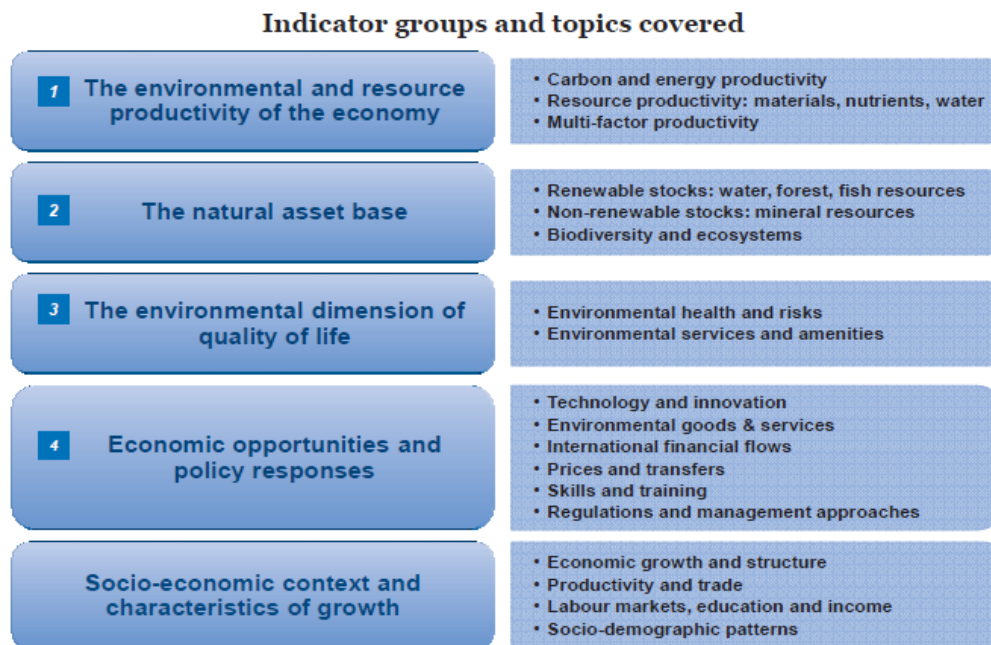[20]   Ecorys (2011) EU industry in a sustainable growth context

| | | • well-being; |
| | | • Shift from non-market to market provision of services (production of home-produced goods is important to assess consumption levels of households in developing countries) |

3.2.5 OECD green growth indicators

The OECD have long been involved in economic development and environmental issues. However, they started to concentrate on Green Growth in particular from 2009, when the OECD Ministerial Council gave a mandate to develop a Green Growth Strategy to be presented to Ministers in 2011. A major aim was to make green growth visible and measurable, with a recognition then that internationally comparable data and indicators were needed. This initiative generated work in several OECD Directorates and a first interim report on the Green Growth strategy was presented to the OECD Council meeting at ministerial level in May 2010. The framework of the strategy is policy-oriented, and dominated by discussions about externalities and market failures and how these can be changed to foster environmentally compatible economic growth.[21]

Following this meeting, in 2011 the report "Towards Green Growth: Monitoring Progress" was published and other publications followed, including topics such as freshwater, forest, fish, minerals, land, soil and wildlife. Green growth was integrated into OECD analytical work to provide concrete, targeted advice and, from 2012, developing countries are also involved in the analysis.

The OECD green growth work focuses on production of a set of 25 key performance indicators to illustrate sustainable growth. The indicator groups and topics are outlined below, within each of these a selection of specific indicators are proposed.

Indicator groups and topics covered

1 **The environmental and resource productivity of the economy**	• Carbon and energy productivity • Resource productivity: materials, nutrients, water • Multi-factor productivity
2 **The natural asset base**	• Renewable stocks: water, forest, fish resources • Non-renewable stocks: mineral resources • Biodiversity and ecosystems
3 **The environmental dimension of quality of life**	• Environmental health and risks • Environmental services and amenities
4 **Economic opportunities and policy responses**	• Technology and innovation • Environmental goods & services • International financial flows • Prices and transfers • Skills and training • Regulations and management approaches
Socio-economic context and characteristics of growth	• Economic growth and structure • Productivity and trade • Labour markets, education and income • Socio-demographic patterns

These indicators tend to draw on existing indicators compiled by the OECD and other organisations, although some groups and indicators require further development to become

---

[21] Fifth Meeting of the UN Committee of Experts on Environmental-Economic Accounting New York, 23-25 June 2010

operational or to improve data coverage across nations. The OECD work is aligned with the SEEA framework, taking a lead from it, and where possible its indicators are designed to apply the methodological lessons from the SEEA. The approach based on taking stocks and flows within an SEEA or SNA model, and deriving appropriate ratios or other indicators to improve policy understanding, for example relating carbon emissions or material flows to an economic measure such as GDP to derive productivity (intensity) measures.

A version of the proposed OECD approach was trialled in 2011 by the statistical office of the Netherlands, which published a report "Green growth in the Netherlands"[22]. They derived indicators closely matching the OECD set from the Dutch version of SEEA type environmental economic accounts. For the Netherlands not all of the OECD-indicators were thought relevant and therefore they selected 18 of the 25 proposed and added two further indicators themselves (carbon emission trading and environmental investment).

The Dutch report relates the environmental to the economic, e.g. the emissions caused by production and consumption and/ or materials used, to economic outputs. Furthermore they calculate the surplus of nitrogen and phosphorous in agriculture and emphasise the central theme of biodiversity in green growth. This demonstrates clear links between the OECD indicators and SEEA framework and is consistent with the approach proposed in the Stiglitz report. The links are most evident in indicators such as the share of green taxes, which belongs to group four of the OECD indicators and is closely connected to category 3 - economic activity – of the SEEA framework; the production and consumption-based greenhouse gas emissions which fit in the first category of SEEA; and the whole third part of the Dutch report, category two in the OECD indicators and related to the asset stocks and flows in SEEA.

The report provides a clear and comprehensive example of how these indicators were prepared and could be presented, and identified some of the issues faced, such as the need for further work on indicators for the 3rd theme – the environmental quality of life. The speed with which this was prepared is remarkable, only two years after the OECD started their programme. One of the key issues in replicating this approach would be data availability and this will be closely linked to the existence of some form of environmental accounting or, at least, monitoring data of environmental stocks and flows. While this is available for some developing countries, such as those highlighted in section 3.2.1, it is far from universal and would be a significant first hurdle for many countries.

Critique

The OECD indicator set is relatively new and therefore there has been little review of the set as a whole. Yet many of the indicators within the set have been used for a longer period and can be calculated back much further. As such, most critique focuses on indicator specific issues, some of these and the more general issues are briefly summarised below:

- **Use of ratio indicators** – use of ratios makes assumptions of relationships, can hide the drivers of cause and effect and can move the focus away from important total figures, for example in the case of carbon emissions it is a good thing if carbon intensity is decreasing, i.e. fewer emissions for the same unit of economic output, but what is truly important, in the sense of global thresholds, is total emissions. Part of this is a presentational issue and it is notable that the Dutch example provided both total and intensity-based data.
- **Assumptions underlying resource use indicators** – material flow accounting is one of the newest areas of environmental accounting with systems and data fragmented. To deal with this

---

22   NL CBS (2011) Green growth in the Netherlands

a large number of assumptions are made for an 'rucksack' of materials used in an economy, i.e. of each tonne of general materials used a % proportion of it is assumed for each individual material, this technique is relatively new and still being tested and refined.

- **Gaps in scope –** it has been noted that the OECD indicator set has little or no coverage of adaptation or resilience indicators, this is an important gap in terms of environmental sustainability. Other areas of note that are missing are for energy a measure of security of supply.

3.2.6   UNEP Green Economy Initiative

UNEP launched their Green Economy Initiative (GEI) in the late 2008. It is a program initialized by numerous experts from UN organizations, academic institutes, think tanks, businesses and environmental groups. The main issue of the GEI is raising awareness and addressing issues of concern and the evaluation of the UN Millennium Development Goals. The reports were presented at the "United Nations Conference on the World Financial and Economic Crisis and Its Impact on Development" and Group of Twenty (G20) leaders at their 2009 Summit in London. To date, more than a dozen national governments in Africa, Asia-Pacific, Europe and Asia have requested support from the UN for launching green economy initiatives in their respective countries

The focus of the framework is more on sectors rather than themes, because developments of different areas are interwoven and influence each other. The topics involve greening world trade, markets and finance, green energy, green technology, green transport, global forest resources and the world water assessment. The indicators finally chosen are the ones that are most relevant in their respective categories.

The indicators used in the UNEP Green Economy Initiative are largely derived from GDP and related economic, environmental and social indicators, as shown in the figure below. The first set has some scope to crossover with SEEA type indicators, by accounting for environmental investments, environmental goods and services and green jobs. The second group of indicators measures the decoupling of economic productivity and human well-being from resource and emission intensity, including eco-efficiency, re-use and recycling, doing more with less, substitution and material flow indicators. This information is mainly based on the International Resource Panel. The third element of the indicators leaves scope for green growth and wellbeing type indicators, and refers specifically to adjusted net savings.
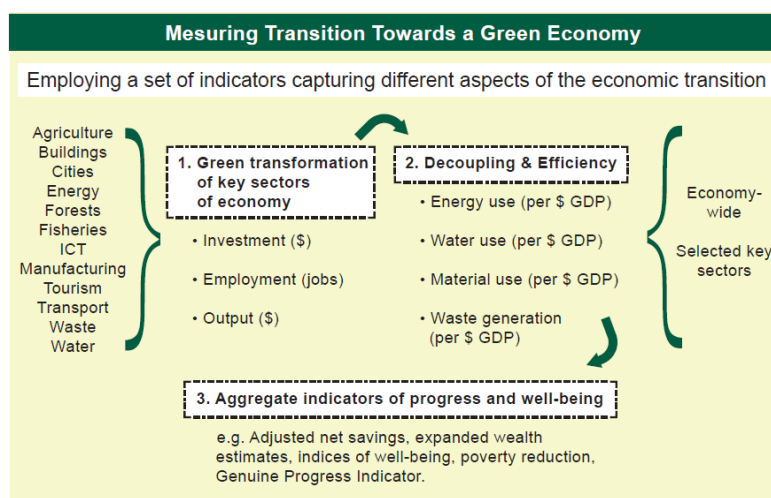
Source: UNEP – Green Economy Initiative

Data has been collected for each indicator for every country of each sub-region for the following years - 1990, 1995 and 2000.

ECORYS   Survey of green growth / environmental sustainability accounting and indicators

UNEP also work directly with the World Bank and OECD, and in their Green Economy report[23] also frame sustainable development for nations in terms of the HDI (see section 2.3) and the Ecological Footprint, as shown below.

Source: Global Footprint Network (2010); UNDP (2009)
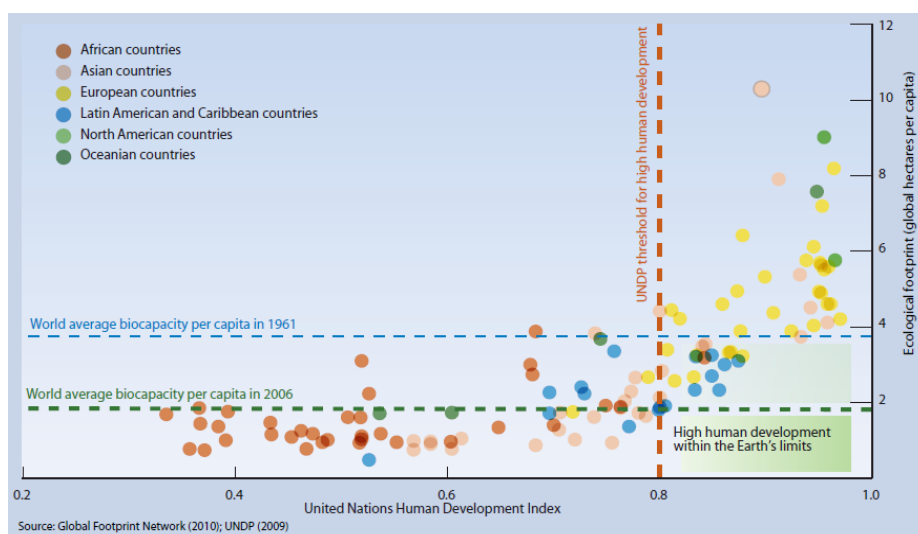
3.2.7 The Economics of Ecosystems and Biodiversity (TEEB)

TEEB is an international initiative to draw attention to the global economic benefits of biodiversity and to highlight the growing costs of biodiversity loss and ecosystem degradation. It was initiated in 2007 and consists of five main steps:

- The first step had the aim to synthesize and present the latest ecological and economic knowledge, to structure the evaluation of ecosystem services under different scenarios, and to recommend appropriate valuation methodologies for different contexts.
- The second and third steps aimed to develop guidance for policy makers at international, regional and local levels in order to foster sustainable development and better conservation of ecosystems and biodiversity.
- The goal of the fourth step was the provision of information and tools to improved biodiversity-related business practices.
- In a last part the TEEB aims to raise public awareness of the contribution of ecosystem services and biodiversity towards human welfare and ecosystems.

The technical framework proposes a typology of 22 ecosystem services divided in 4 main categories (according to the Millennium Ecosystem Assessment);

1. **Provisioning:** nature directly provides some resources like crops, raw material, fresh water or ingredients for certain products e.g. medicine;
2. **Regulating:** nature regulates different processes from which humans directly benefit, e.g. filtration of pollutants by wetlands, climate regulation by evaporation or carbon storage and pollination.
3. **Habitat and cultural:** representing nature as place of recreation, leisure and education, but also to guarantee the maintenance of genetic diversity.
4. **Amenity services:** nature supports and provides some services like photosynthesis and nutrient cycling that are essential for human viability.

These services from natural capital can be seen as a natural 'dividend' which would be/ is destroyed by the degradation of ecosystems and biodiversity. In this context the concept of

---

[23] UNEP (2011) Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication

resilience is of a great importance, because it keeps the dividends of the ecosystem alive, even if the conditions are changing.

Measurement is determined by three dimensions of indicators:

1. Economic (prices, GDP)
2. Socio-cultural (human well-being indices)
3. Biophysical (resilience)

This is necessary, because the framework distinguishes between socio-cultural and economic benefits and values. The reason for separating benefits and values is because people have needs which, when fulfilled, are translated into benefits. TEEB focuses on the economic element of the loss of biodiversity and giving this loss a monetary value. This is necessary to make a link with other standard macroeconomic indicators and to facilitate the implementation of the indicator in the policy field. An additional advantage of this monetisation is in how it is simpler and easier to communicate and raise awareness.

As noted in the section on SEEA, TEEB is being used as a crucial building block in the experimental ecosystem accounts framework being developed with the issues of biodiversity accounts and indexes and principles of monetary valuation among those most relevant. Supported by other information, the intention from SEEA is to develop a new Common International Classification for Ecosystem Services (CICES), which will take on the TEEB framework and classification system to varying extents. WAVES is also relevant to TEEB in this sense as it is one of 3 main players in developing the SEEA experimental ecosystem accounts and also that the WAVES pilots will test and implement TEEB based methodologies, with Colombia the most directly stated example.

3.2.8 Other measures

A number of other measures have been developed. Many of these efforts have been led by national governments, with China and Botswana among the highest profile efforts (also see list in SEEA section) and these efforts aligned to varying degrees with the 1993 and 2003 SEEA frameworks.

China pioneered development of a green national accounts system, a report on green GDP for 2004 was published in 2006. Green GDP in this sense being a figure for GDP adjusted for environmental degradation and damage, similar to a first step of the aNNI approach being used by the World Bank. The methodology included costs for environmental damage and degradation. The results reported that when adjusted for these environmental costs national GDP growth was actually -3%. This was controversial politically and the measure was understood to have faced significant opposition from officials whose priorities and career prospects were tied to economic growth data. Others criticised the complexity of the methodology where it was argued that including all environmental sustainability aspects in a single figure did not adequately reflect the multiple facets. The programme was dropped after its first report. There are reports[24] that an alternative, GDP quality index is being developed by China that will provide complementary figures to GDP, ranking not only economic growth but its sustainability, social equality and ecological impact.

Botswana is an interesting example of a relatively small developing country which has significant resource wealth. It has developed environmental economic accounting systems to help manage this wealth and require that resource revenues (primarily from diamonds) are reinvested in the

---

[24]   http://www.guardian.co.uk/environment/2011/sep/16/china-green-economist-gdp

economy. As put in the World Bank Where is the Wealth of Nations report "There are no sustainable diamond mines, but there are sustainable diamond-mining countries." By ensuring that a certain proportion of revenues are reinvested in the economy it has successfully stimulated more sustainable growth, with high levels of adjusted net saving by World Bank measures. The system in Botswana is primarily based on an SEEA type approach that measures stocks of environmental assets and flows in physical and monetary terms, although only water is measured in also monetary terms. The accounts system in Botswana was built up over time, gradually incorporating individual natural assets and resources.

The Environmental Performance Index[25] produced by Yale University in the United States offers an index of environmental performance that covers a wide range of environmental impacts. It developed from work on an Environmental Sustainability Index from 2000-2005, to publish a first Environmental Performance Index (EPI) in 2006. Updated EPI have been published biennially since then, with a 2012 update now available that covers 132 countries, although data is not comparable over time as the methodology has been revised in each version. A trend ranking has been included in the 2012 version to enable some analysis of trends.

The following figure[26] provides an overview of the two objectives, 10 policy categories and 22 indicators tracked by the EPI, and the percentages illustrate the weighting that is applied to each when aggregating to a final index score. As with any composite index the way in which it is aggregated and the weightings that are assigned are an area of strong debate and political discussion. Data availability is also an issue in the preparation of the index and although quality assessments are carried out to tend towards more robust data there are gaps and elements of modelling included in the calculations.
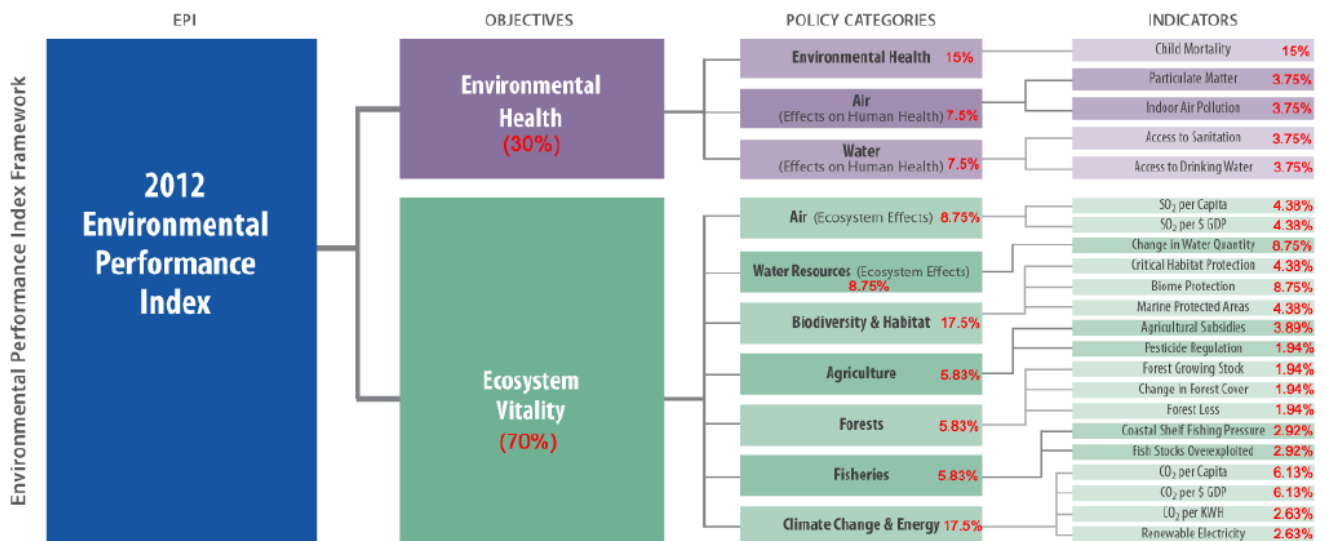
Figure 2.1. The Indicator Framework of the 2012 Environmental Performance Index. The percentages indicate the weightings used for aggregation (discussed in Section 2.4).

The indicators are scored individually on a 'distance-to-target' basis, with the target set to 100 and the lowest scoring country set to 0. Countries are then scored on their relative position within this range. Setting targets is another difficult area, in some, for example sanitation, it is relatively simple with a 100% access to sanitation target, but other targets, such as marine protected areas, are

---

25   Available at http://epi.yale.edu/
26   From: Emerson, J.W., A. Hsu, M.A. Levy, A. de Sherbinin, V. Mara, D.C. Esty, and M. Jaiteh. (2012) 2012 Environmental Performance Index and Pilot Trend Environmental Performance Index. New Haven: Yale Center for Environmental Law and Policy.

much more open to debate. The targets chosen are defined and explained in the indicator metadata published on the website and are based where possible on international agreements or standards, national targets or expert judgement based on scientific evidence.

While not a measure of green growth as such, the EPI could be used in combination with economic measures to provide a more rounded picture of sustainability. It does attempt to draw in an economic perspective on some measures by framing them in terms of intensities, per capita values or subsidies, but this is not a particularly deep economic analysis and would need to be supported by more comprehensive measures. Users of the EPI data include indicators such as the Sustainable Society Index (see 3.3.6).

Table 3 Summary of directly relevant green growth indicator / framework characteristics

	System of Environmental-Economic Accounts (SEEA)	Adjusted Net Savings (ANS) – World Bank	WAVES -World Bank	Ecological Footprint - Global Footprint Network	OECD green growth indicators	UNEP Green Economy Initiative (GEI)
Organisation	UN (UNSD)	World Bank	World Bank	Global Footprint Network	OECD	UN (UNEP)
Description	The SEEA is a framework methodology to incorporate the environment into national economic accounts,	A measure that attempts to better reflect the sustainability of a national economy by looking at depletion and investment in capital, including natural resource capital.	Awareness raising to introduce the practice of ecosystem valuation into national accounts at scale so that better management of natural environments becomes "business as usual".	A resource accounting tool which measures how much land and water area a human population requires to produce the resource it consumes.	Indicator system consisting of four indicator groups (approximately 25 indicators) with the aim of sending clear messages to policy makers and the public at large.	UNEP developed a framework for environmental indicators to identify key indicators of air, water, land and biodiversity. Special in their approach is the use of sectoral indicators.
Created	Created in 1993 following Rio '92, revised every 10 years: 2003 & 2013. Current revision underway, first element – central framework – now approved.	The ANS approach has been developed since 2002, it was presented in the Where is the Wealth of Nations? report in 2006.	October 2010 – next meeting April 2012 Implementation planned 2012-2015	Founded 2003 – Living Planet Report 2010	2011 "Towards green growth: Monitoring Progress – OECD Indicators"	2008 – Last report 2011
Objective	- To integrate environmental stocks and flows in national economic accounts - To provide better information to policy makers to make more informed decisions,	To provide national-level decision makers with a clear, relatively simple indicator of how sustainable their country's investment and natural capital management policies are.	WAVES: - Implement natural capital and/or ecosystem accounting in 6-10 countries. - Incorporate the accounts into policy analysis and development planning and promote adoption beyond the pilot countries. - Test and develop internationally accepted and standardized guidelines for the implementation of ecosystem accounting.	- Point out new solutions and spark a global dialogue about ecological limits and overshoot - Develop an international Footprint standard	- Understanding of the different factors affecting green growth - Providing internationally comparable data - Fostering sustainable economic development	- To assist countries in developing a framework on indicators for measuring progress on environmental sustainability; - Capacity building on development of indicators framework for environmental performance assessment; and - To facilitate the assessment of state of the environment and sustainable development at the subregional level.
Type	Framework	Indicator	Application	Indicator	Indicator set	Indicator set
Construction	Builds on system of national accounts (SNA). Based on stocks and flows of the economy and environment. Calculated in physical, monetary and financial	Derived primarily from SNA data. Based on calculation of produced, natural and intangible capital.	The WAVES pilots could potentially use a variety of methodologies and constructions. The clearest links are to SEEA, TEEB and the World Bank – ANS.	Calculates both the Ecological Footprint (demand on nature), and biocapacity (capacity to meet this demand)	25 indicators, across 5 categories. Typically sourced from existing datasets from national accounts or other agencies.	GDP, calories per capita, population below US$ day, Human Development Index (HDI), employment in green investments sectors (from agriculture to transportation), forest land, water

	System of Environmental-Economic Accounts (SEEA)	Adjusted Net Savings (ANS) – World Bank	WAVES -World Bank	Ecological Footprint - Global Footprint Network	OECD green growth indicators	UNEP Green Economy Initiative (GEI)
	terms.					demand, waste generation, total landfill, biocapacity or ecological footprint, CO2 emissions, primary energy demand, and the share of renewable energy in primary demand
Scope:	The Central Framework covers environmental and economic assets, with a primary focus on: • Land • Energy • Water • Forests / Timber • Air (emissions) Experimental Ecosystem accounts are also being developed.	Wealth of nations cover the following environmental and natural capital depletion and degradation. • Energy and mineral resources • Timber forest resources • Non-timber forest resources • Crop land • Pasture land • Protected areas • Emissions to air (GHG, particulates) Also explicitly considers investment in education.	WAVES pilots focus and scope will vary by country – overall, within a general environmental-economic accounting structure it is likely to have an ecosystem based focus.	3 main areas: • primary products (from cropland, forest, grazing land and fisheries) • demand for food, fibre, timber, energy and space for infrastructure • carbon dioxide emissions	5 main areas: • Environment and resource productivity of the economy • Natural asset base • The environmental dimension of quality of life • Economic opportunities and policy responses • Socio-economic context and characteristics of growth	Since 2012 concentration on three types of indicators: • economic transformation • resource efficiency • progress and well-being. In areas of: Agriculture, fisheries, water, forests, renewable energy, manufacturing industry, waste, buildings, transport, tourism
Land	X	X	?	X	X	X
Ecosystems	X [tbd]		Very Likely	X	X	
Forests	X	X	?	X	X	X
Fisheries	X		?	X	X	X
Biodiversity	X [tbd]		?		X	
Air	X	X	?	X		X
Water	X	X	?	X	X	X
Materials	X	X	?	X	X	X
Take-up	Revision of central framework recently approved. At least 25 countries implemented some form of environmental accounts to date, using the SEEA to varying	ANS data is prepared by the World Bank for approximately 120 countries	• Meeting 2011: Australia, Canada, Columbia, France, India, Japan, Netherlands, Norway, UK, US and IO's and NGO's • Pilot countries: Botswana, Colombia,	National Footprints are produced for over 150 countries The GFN has membership from around 200 cities, 23 nations, leading	Varies by indicator. Netherlands has undertaken the most comprehensive assessment based on the OECD indicator set.	20 countries

	System of Environmental-Economic Accounts (SEEA)	Adjusted Net Savings (ANS) – World Bank	WAVES -World Bank	Ecological Footprint - Global Footprint Network	OECD green growth indicators	UNEP Green Economy Initiative (GEI)
	extents.		Costa Rica, India, Madagascar and Philippines	business, scientists, NGOs, academics (a network of 90 global partners)		
Results	The revised SEEA framework is expected to be the international standard for the foreseeable future. [	• The Changing Wealth of Nations: Measuring Sustainable Development for the New Millennium (World Bank 2010) • Data published annually	• 2012 Preliminary report to Rio+20 Summit	• Frequently published reports • Frequently updates data	Some indicators already published on website.	Success stories from projects highlighted under the GEI as a whole published on website.
Pros	• Builds on SNA • Will be internationally agreed standard. • Strong stakeholder involvement • Physical and monetary stocks and flows • Wide scope • Brings together and standardises best practices from past experiences over 20 years	• Single clear indicator • Draws on accessible SNA data • Relatively easy to calculate • Data requirements relatively light • Includes range of natural resources	• Aligned with SEEA • Build on TEEB • Well financed ($15 million) • Supporter by a wide forum of partners	• Applicable on an individual, a region, all of humanity, or a human activity • Easy to visualize and communicate	• Environment and economy seen as one • Comprehensive approach • Indicator set can cover wider scope and other dimensions, e.g. social, production and consumption	• Logical summary of relevant areas • Broad concept with detailed elaboration of indicators
Cons	• Is only a data system, does not drive sustainability on its own • Accounting for non-renewable resources • Valuation of resources • Quality aspects not included • Social dimension not included • Alignment of environmental sector with SNA – ISIC categories is weak	• Substitutability of environmental capital • Investment does not always equal quality / outcomes • Focus on production perspective • Social dimension not included • Valuation of resources • Questions on assumptions – discount rates, sustainable consumption growth rates, capital asset lifetimes	Will depend on approaches taken – problems similar to SEEA and WAVES are likely.	• Over simplifies issues • Narrow scope • Weak differentiation between energy impacts. • Only valid for materials that are created by biological processes • Bias to large, sparsely populated countries • Limited policy relevance	• Indicator set is more complicated to communicate • Difficult to find data for all indicators • Gaps in scope – i.e. adaptation and resilience • Large assumptions behind some indicators – especially resource flow base data • Use of ratio indicators relies on assumed relationship	• No immediate relevance for those interested in regional discussion • Data requirements • Weak linkages to other issues relevant to mainstreaming the environment
Links	Framework works with all major organisations in this field, will link to almost all.	From SNA, to WAVES, OECD and other indicators e.g. SSI (see 3.3)	Likely to be connected/ based on TEEB and SEEA. Also Poverty-Environment Initiative, UK National Ecosystem	Human Development Index. Attempts being made to link to SEEA.	Cooperation with UNEP and Eurostat. Alignment with SEEA – many indicators will be derived from it.	Links within UN and also through Green Growth Knowledge Platform to World Bank, OECD and others.

	System of Environmental-Economic Accounts (SEEA)	Adjusted Net Savings (ANS) – World Bank	WAVES -World Bank	Ecological Footprint - Global Footprint Network	OECD green growth indicators	UNEP Green Economy Initiative (GEI)
			Assessment, The Natural Capital Project			
Data source / reference	http://unstats.un.org/unsd/envaccounting/seea.asp		available at: http://www.worldbank/programs/waves http://www.proecoserv.org/information-hub/doc_view/34-proecoserv-wb-waves-lange.raw?tmpl=component	available at: http://www.footprintnetwork.org	available at: http://www.oecd.org/document/58/0,3746,en_ 2649_37425_48303098_1_1_1_37425,00.html OECD (2011) Towards Green Growth OECD (2011) Towards Green Growth - Monitoring Progress: OECD Indicators	available at: http://www.unep.org/IEACP/iea/training/manual/module5/1214.aspx http://www.unep.org/greeneconomy/Portals/88/GE_INDICATORS%20final.pdf

3.3 Profiles of indirectly relevant frameworks / indicators

This section presents a short description of the major frameworks / indicators identified as indirectly relevant to green growth under category 2.

3.3.1 Multidimensional Poverty Index (MPI)

The Multidimensional Poverty Index (MPI) is an international poverty measure developed by the Oxford Poverty and Human Development Initiative (OPHI) and the United Nations Development Programme Human Development Report Office (UNDP HDRO) for the UNDP's flagship 'Human Development Report'.

The MPI identifies multiple deprivations at the individual level in health, education and standard of living, using a set of 10 indicators (see table). A person in a given household is considered as multidimensionally poor if the weighted indicators in which he or she is deprived add up to at least 33%. These data are then aggregated into the national measure of poverty. The MPI complements income poverty and Millennium Development Goals (MDGs) measures by reflecting the acute deprivations people are experiencing at the same time.

In comparison to the indicators and frameworks mentioned in section one, the MPI focuses much more on social and educational aspects, environmental components are more or less missing. There is a rationale for the strong focus on the social aspects as they are difficult to assess and translate into economic or monetary terms. As the definition of sustainability also contains the social component it could be advantageous to incorporate the MPI in one of the other frameworks for a more holistic and comprehensive indicator.

The MPI methodology shows aspects in which the poor are deprived, reveals the interconnections among those deprivations and helps understand poverty patterns. Thereby, it can enable policymakers to allocate resources and design policies more effectively. This is especially useful where the MPI reveals areas or groups characterized by severe deprivation.

3.3.2 UN Millennium Development Goals (MDGs)

The Millennium Declaration, endorsed by 189 world leaders at the UN in September 2000, is a commitment to work together to build a safer, more prosperous and equitable world. The Declaration was translated into a roadmap setting out eight time-bound and measurable goals to be reached by 2015, known as the Millennium Development Goals (MDGs). The MDGs are the most broadly supported, comprehensive and specific development goals the world has ever agreed upon.

The MDGs include goals and targets on income poverty, hunger, maternal and child mortality, disease, inadequate shelter, gender inequality, environmental degradation and the Global Partnership for Development. Progress towards the eight MDGs is measured through 21 targets and 60 official indicators.

The environmental part of the MDG is concentrated on goal 7 – Ensure Environmental Sustainability. With the sub-goals for:
1. Awareness raising
2. Biodiversity: significant reduction by 2010 in the rate of loss of:
   a. 2.1 proportion of land area covered by forest
      2.2 CO_2 emissions, total, per capita and per \$1 GDP (PPP)
      2.3 Consumption of ozone-depleting substances
      2.4 Proportion of fish stocks within safe biological limits

        2.5 Proportion of total water resources used

        2.6 Proportion of terrestrial and marine areas protected

        2.7 Proportion of species threatened with extinction

3. Drinking water
   a. 3.3 half by 2015 proportion of population using an improved drinking water source

       3.4 half by 2015 proportion of population using an improved sanitation facility

4. Slum dwellers
   a. 4.1 improve significantly by 2020 lives of at least 100 million slum dwellers

An interesting aspect of the MDGs is the clear deadline for achievement of the goals.

The MDGs do not directly align with many of the direct indicators, or in terms of sustainability and environment as expressed through them, they are more closely focused on human experience of the environment, from a development context. Only in the area of biodiversity is there some cross-over with some generic indicators on forest area, emissions, resource use and biodiversity, these align to some extent with the OECD and UNEP GEI indicators but are largely generic. They may complement SEEA or World Bank based data.

3.3.3 OECD Your Better Life index

The Your Better Life Index is a key instrument of the OECD Better Life initiative which aims to provide a better understanding of what drives the well-being of people and nations and what needs to be done to achieve greater progress for all.

Your Better Life Index was designed as an interactive tool that allows citizens to see how countries perform according to the importance they give to each of 11 topics that contribute to well-being in OECD countries. In this way it can be judged to align closely with Beyond GDP approaches.

The Your Better Life Index concentrates in environmental aspects on air pollution and especially on particulate matter in the air. Air quality is not really considered in the economic indicators, even if it is closely connected to quality of life and also the general understanding of "green growth". The index is therefore highly focused on the productive side of society and thus differs from most parts of the other indirect indicators.

The index currently profiles the 34 OECD member countries across the 11 topics of wellbeing, and will eventually include the OECD's six partner countries (Brazil, China, India, Indonesia, Russia, and South Africa), representing the world's major economies.

3.3.4 Indices of Social Development (ISD)

The Indices of Social Development (ISD) is hosted by the International Institute of Social Studies of Erasmus University in the Netherlands and was launched in March 2011. It aims at showing how different societies perform along five dimensions of social development – civic activism; clubs and associations; intergroup cohesion; interpersonal safety and trust; gender equality.

The ISD brings together 200 indicators, synthesising them into a usable set of measures and allows the effects of social development for a large range of countries on indicators like economic growth, human development, and governance to be estimated.

The topics of the ISD are relatively similar to those of the MPI, but they focus much more on social connections and networks, safety and gender equality. These indicators are only indirectly related to environmental quality, but, as with the indicators of MPI, do attempt to provide an evaluation of sustainability and to broaden the view of the observer.

The only indices that make directly reference to the environment are:
1. Active member of a environmental group
2. Belong to an environmental NGO

3.3.5 Human Development Index (HDI)

The Human Development Index (HDI) is a summary composite index that measures a country's average achievements in three basic aspects of human development: health, education and living standard. It was first developed by the late Pakistani economist Mahbubul Haq with the collaboration of the Nobel laureate Amartya Sen and other leading development thinkers for the first Human Development Report in 1990. It was introduced as an alternative to conventional measures of national development, such as level of income and the rate of economic growth.

Like the other indicators in this section the HDI is not specialised on environmental topics. The HDI does not directly contain any indicator concerning the environment. But nevertheless the areas of education and living standards can correlate highly with environmental performance. High educational levels and a high quality of life helping to foster the process of greening a economy.

3.3.6 Sustainable Society Index (SSI)

The Sustainable Society Index (SSI) has been developed by the Sustainable Society Foundation, a non-governmental organisation based in the Netherlands. The SSI is based on the well-known and widely accepted definition of sustainability put forward by the Brundtland Commission in 1987. The index integrates human and environmental wellbeing, acknowledging that they only make sense in conjunction. It further assumes that economic wellbeing is not an end in itself, but rather a condition to achieve human and environmental wellbeing.

In contrast to the other indirect frameworks in this section the SSI includes a wide set of environmental indices in its measurement, covering:
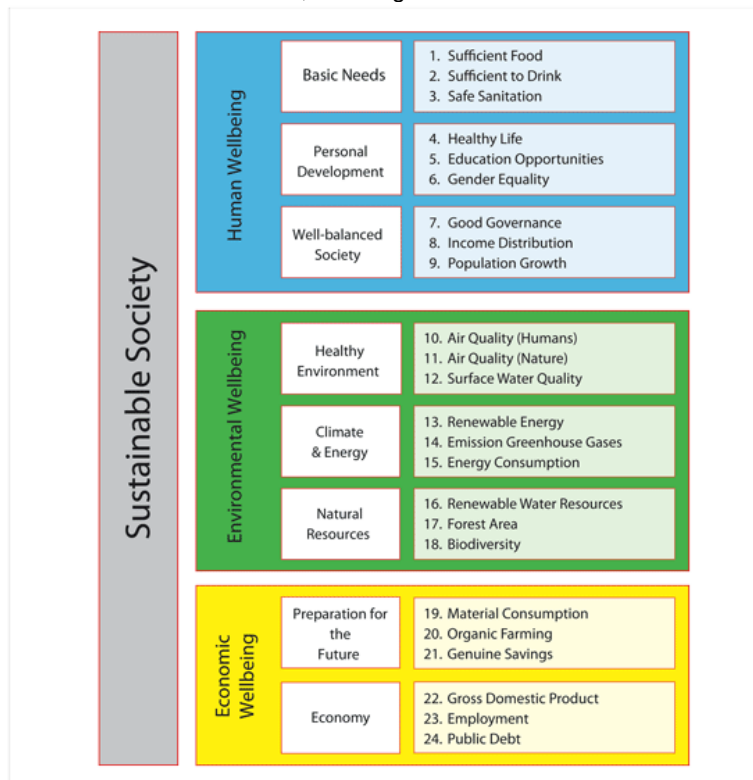
This shows some alignment with the economic environmental frameworks such as SEEA which could also be used to produce such indicators, and OECD data sets which also contain similar indicators. It explicitly contains the ANS and EF indicators and draws data from a variety of other

sources including the World Bank, IEA, FAO, EPI and WRI. Furthermore it covers all three parts of sustainability – environment, society and economy. It is one of the few indicators that combine the consumer and producer side and hence can provide a different insight on the topic.

The methodology is available through the website and takes a similar approach to that used by the EPI (see 3.2.8), using normative indicators and performance to derive index scores. It therefore faces similar concerns in terms of targets, scoring (this varies by individual indicator), and weighting (all 24 indicators are weighted equally).

The advantage of this type of index approach is that it allows simple comparison across countries and tracking performance over time The SSI recognise the criticisms of this type of approach as raised in the Stiglitz report, in terms of both data quality, which should be improved, and relations to real environmental thresholds.

3.3.7 Social Institutions and Gender Index (SIGI)

The Social Institutions and Gender Index (SIGI) is an indicator developed since 2009 by the OECD Development Centre, in collaboration with Göttingen University and the Erasmus University Rotterdam.

124 countries can be compared by means of 12 un-weighted and non-linear indicators to measure the inequalities between women and men in social institutions. This is also one of the main differences in comparison to other indicators which focus mostly on well-being and other aspects.

Among the interesting features of this index is the focus on institutions and their appreciation of gender equity. By concentrating on developing countries it could be complementary to the other approaches, providing a view on how the environmental transformation of a economy is connected to the gender equality of a society. The SIGI does not have any indicator that is explicitly connected to the environment.

3.3.8 Gender Equity Index (GEI)

The Gender Equity Index is a composite indicator developed and calculated by Social Watch since 2007. It measures the gap between women and men and thus illustrates the difference between them. The latest version covers 168 countries across all five continents. Nevertheless, no country has yet reached the aspired level and women's relative economic activity, education and empowerment still show some deficits.

The GEI is very similar to the SIGI and both measure the gender equality of different countries around the world. Although the methodology is similar the GEI also incorporates economic participation and empowerment and could therefore provide new insights into the green growth of an economy and the role of the citizens in this process of transformation. Nevertheless there is also no direct linkage to environmental measurements. This is an interesting gap given the strong links between the environment and social and gender issues in developing countries, with women often responsible for gathering firewood, farm labour and cooking – which when carried out using traditional stoves is highly fuel inefficient and, when indoors, a major cause of respiratory problems.

Table 4 Summary of indirectly relevant to green growth indicator / framework characteristics

	Multidimensional Poverty Index (MPI)	Millennium Development Goals (MDGs)	OECD Your Better Life Index	Indices of Social Development (ISD)	Human Development Index (HDI)	Sustainable Society Index (SSI)	Social Institutions and Gender Index (SIGI)	Gender Equity Index
Organisation	Oxford Poverty and Human Development Initiative (OPHI)	United Nations	OECD	International Institute of Social Studies (ISS), Erasmus University	Created by; managed by UNDP	Sustainable Society Foundation	OECD. Göttingen University and Erasmus University Rotterdam	Social Watch
Description	International index assessing acute multidimensional poverty by measuring 10 indicators that cover aspects related to health, education and living standard.	The Millennium Development Goals (MDGs) are eight targeted development aims designed to free humanity from extreme poverty, hunger, illiteracy and disease by 2015.	Interactive tool allowing users to allocate importance to 11 topics contributing to wellbeing in OECD countries.	Aggregate index of five distinct dimensions of social development	A composite index measuring average achievement in three basic dimensions of human development—a long and healthy life, education and a decent standard of living.	The SSI is an index measuring progress towards sustainable development. It covers aspects related to human, environmental and economic wellbeing.	The Index is a comparative approach to measure gender equality, based on the OECD's Gender, Institutions and Development Database.	The Gender Equity Index (GEI) measures gender inequalities around the world based on three dimensions, education, economic participation and empowerment.
Created	Launched in July 2010; new data included in 2011	September 2000	May 2011	Launched March 2011	Developed in 1990; revised in 2010	2006 and is updated every two years.	Construction and latest results from 2009	2004 computed by Social Watch, latest version 2012
Objective	- create a comprehensive picture of people living in poverty - compare incidence and intensity of poverty both across countries, regions and the world and within countries by ethnic group, urban or rural location	Reach MDGs by 2015	The Index aims to involve citizens in the ongoing debate on measuring the well-being of societies, and to empower them to become more informed and engaged in the policy-making process that shapes everybody's life.	- Provide better aggregate measures of social development than are currently available - Enable comparison of countries' performance concerning social development - Help policy-makers focus on areas where a concentrated development policy can add true value	The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone.	- Provide an easy and transparent instrument to measure the level of sustainability of a country and to monitor progress to sustainability - stimulate progress on the way towards sustainability	- Showing regional disparities in gender equality - Investigate regional trends - Describe gender equality changes and developments over time	- make gender inequities more visible - illustrate gaps between women and men in different areas - monitor the evolution in the different countries of the world
Type	Indicator	Indicator	Indicator	Index	Indicator	Indicator	Indicator	indicator

	Multidimensional Poverty Index (MPI)	Millennium Development Goals (MDGs)	OECD Your Better Life Index	Indices of Social Development (ISD)	Human Development Index (HDI)	Sustainable Society Index (SSI)	Social Institutions and Gender Index (SIGI)	Gender Equity Index
Construction	The MPI relies on three main databases that are publicly available and comparable for most developing countries: the Demographic and Health Survey (DHS), the Multiple Indicators Cluster Survey (MICS), and the World Health Survey (WHS).	8 goals, measured through 21 targets and 60 official indicators: Data is typically drawn from official statistics provided by governments to the international agencies responsible for the indicator. To fill data gaps, data for many of the indicators are supplemented by or derived exclusively from data collected through surveys sponsored and carried out by international agencies.	The data mostly come from official sources such as the OECD or National Accounts, United Nations Statistics, National Statistics Offices. A couple of indicators are based on data from the Gallup World Poll. More than 80% of the indicators in *Your Better Life Index* have been already published by the OECD.	The indices are composed from 25 reputable data sources for 193 countries, over the period from 1990 to 2010, and are updated as new data becomes available.	The HDI is, to the extent possible, calculated based on data from leading international data agencies (e.g. UN DESA, UNESCO, World Bank, IMF) and other credible data sources available at the time of writing.Many data gaps still exist in even some very basic areas of human development indicators.	Data sources for each dimension Human wellbeing: FAO, WHO, UN Population Division, UNESCO, World Economic Forum, World Bank Environmental wellbeing: Environmental Performance Index, IEA, CDIAC, MDG Indicators, WRI, Aquastat, FAO, IUCN Economic wellbeing: Global Footprint Network, FIBL, World Bank, IMF, CIA World Factbook, ILO	12 innovative indicators on social institutions, which are grouped into 5 categories. The range goes from 0 (totally equal) to 1 (fully unequal)	Eleven indicators in three dimension scale from 0 (e.g. no women is educated at all and all men are) to 100 (perfect equality). The indicators are also weighted according to population to account for disparities in the population UNESCO and IPU data are used to calculate indicators of the dimensions
Scope:	10 indicators covering three dimensions: • Education: • Health: • Living standard:	• Poverty and hunger • Education • Gender equality • Health • Environmental sustainability • Development	11 topics, measured by 25 individual indicators: • Community; • education; • environment; • governance; • health; • housing; • income; • jobs; • life satisfaction; • safety; • work-life balance	Five dimensions covered; • Civic Activism • Clubs and Associations • Intergroup Cohesion • Interpersonal Safety and Trust • Gender Equality	Three different dimensions, measures with four indicators: • Health • Education • Living standards	The SSI covers 3 wellbeing dimensions, using 8 different categories, which are measured with 24 indicators (3 per category) • Human wellbeing • Environmental wellbeing • Economic wellbeing	Ranks gender on following issues • Family Code • Physical Integrity • Son Preference • Civil Liberties • Ownership Rights	Ranks gender on following issues • Education • economic participation • women empowerment

	Multidimensional Poverty Index (MPI)	Millennium Development Goals (MDGs)	OECD Your Better Life Index	Indices of Social Development (ISD)	Human Development Index (HDI)	Sustainable Society Index (SSI)	Social Institutions and Gender Index (SIGI)	Gender Equity Index
Take-up	The 2011 Human Development Report (HDR) presents estimates for 109 countries with a combined population of 5.5 billion (79% of the world total).	Near universal coverage, but limited by data availability	Covers the member states of the OECD (34 countries) Over time, the Index will expand to cover the OECD's six partner countries: Brazil, China, India, Indonesia, Russia, and South Africa.	193 countries covered	In 2011, the HDI has been calculated for 187 countries and territories.	151 countries covered	124 non-OECD countries,	Covers 168 countries on all continents (version 2012)
Results	About 1.7 billion people in the countries covered—a third of their entire population—lived in multidimensional poverty between 2000 and 2010. This exceeds the estimated 1.3 billion people in those countries who live on $1.25 a day or less (though it is below the share who live on $2 or less).	Positive progress on poverty reduction, education, child mortality, malaria control, tuberculosis, drinking water and HIV/AIDS. Less progress on: child nutrition, employment, sanitation, housing.	Country performance according to OECD Better Life Index: • Exceptionally well: AU, CA, DK, NO, NZ, SE • Very well: AT, BE, CH, DE, FI, FR, IE, IS, LU, NL, UK, US • Favourably: CZ, ES, IL, IT, JP, SI • Moderately well: EL, HU, KR, PL, PT, SK • Low: CL, EE, MX, TR	Achievements and challenges facing societies across the world: from the richness of community life in Sub-Saharan Africa, to the high levels of personal safety and security in the Persian Gulf, to violence in the Caribbean. mprovement over time: the growth of civic engagement in Eastern Europe, gender empowerment in the Middle East, or inclusion of minorities in Southern Africa.	Since 2006, Norway, Australia, the Netherlands, the United States and New Zealand have formed the top five of countries with the highest HDI. During the same time period, Chad, Mozambique, Burundi, Niger and DR Congo have been the five least developed countries.	The world at large is – with a score of 5.9 on a scale of 0 to 10 – only just over halfway to a sustainable world. Economic Wellbeing is lagging behind the environmental and human wellbeing. North & West Europe show the highest SSI score of all regions, 6.9, whereas Sub Saharan Africa has the lowest score of 5.3.	High level of discrimination in South Asia, sub-Saharan Africa and the Middle East and North Africa. Half of the countries at the bottom of the index are located in sub-Saharan Africa At the top, we find countries from Latin America, Eastern Europe and Central Asia with Paraguay on top; Sudan is the country that occupies the last position, followed by Afghanistan, Sierra Leone, Mali and Yemen	The gender gap is not narrowing in most countries Europe and North America scores top with (73), the East Asia and Pacific (69), Latin America and the Caribbean, (68), Central Asia (64), Sub-Saharan Africa (52), Middle East and North Africa (43), and South Asia (39) No country in the world has reached GEI 90 points or more, meaning that no country has yet reached the acceptable level

Survey of green growth / environmental sustainability accounting and indicators

	Multidimensional Poverty Index (MPI)	Millennium Development Goals (MDGs)	OECD Your Better Life Index	Indices of Social Development (ISD)	Human Development Index (HDI)	Sustainable Society Index (SSI)	Social Institutions and Gender Index (SIGI)	Gender Equity Index
Links	Human Poverty Index: The MPI replaced the HPI which was unable to identify specific individuals, households or larger groups of people as jointly deprived. Millennium Development Goals: The MPI indicators are drawn from the MDGs as far as the available internationally comparable data allow. The 10 indicators of the MPI are identical, or relate, to MDG indicators: nutrition (MDG 1), child mortality (MDG 4), access to drinking water (MDG 7), access to sanitation facility (MDG 7) and use of an improved source of cooking fuel (MDG 9).	To other UN programmes, OECD, national governments. MDGs are internationally significant, Also see MPI	The dimensions 'education' and 'health' of the HDI are also covered in the OECD Your Better Life Index, but the indicators used for measuring are not always the same.	Dimension of gender equality relates to MDG Goal 3. See also SSI	Not related to environmental sustainability MPI covers the same dimensions as the HDI, but the indicators used for measuring are not identical. See OECD YBLI. Also education and health dimensions also relate to the MDG Goals 1, 2, 4 and 5. Again, the indicators used differ.	The SSI uses data directly from the EF, ANS and EPI approaches listed in section 3.2, some indicators also very closely align with the OECD Green growth indicators. The 'human wellbeing' dimension covers the three dimensions of the MPI but the indicators used differ. Except for MDG Goal 8, all other MDG Goals are more or less covered by the SSI. Many of the topics of the OECD Your Better Life Index are covered by the SSI, but again, their measurement differs. The only overlap between the ISD and the SSI lies in the topic of gender equality. The dimensions of the HDI are included in the categories 'personal development' and 'economy'.	The index that comes closest to the SIGI is the Women Social Rights Index (WOSOC) Overlap with ISD (Gender Equity) The Indicator is related to other indicators, (the Gender-related Development Index (GDI) and the Gender Empowerment Measure (GEM), the Global Gender Gap Index (GGG), the Women's Social Rights Index, the Gender Gap Index Capped and a revised Gender Empowerment Measure) but non-redundant, it measure a special aspect of gender inequality, namely social institutions	Built on the same framework as the HDI and the IHDI • similar results of Social Watch (GEI) and the UNDP's (GII) • overlaps and similarities with HDI and ISD
Data source / reference	OPHI (2011) MPI Research Brief. UNDP (2012) Multidimensional Poverty Index (MPI).	UNDP (2011) The Millennium Development Goals Report 2011.	OECD (2011) Your Better Life Index:	ISS (n.d.) Indices of Social Development	UNDP (2011) Human Development Index and its component.	SSF (2010) Sustainable Society Index.	OECD	Social watch

3.4   Relationships between identified frameworks / indicators

The following figures present visualisations of the relationships between the major frameworks and indicators profiled in this report, firstly from a theoretical/methodological perspective, secondly from an organisational perspective.

Methodological links and alignment

There are a number of underlying frameworks for methodological approaches to green growth accounting and indicators. The figure demonstrates that the System of National Accounts (SNA) and its accounting of economic assets and their stocks and flows underpins accounting systems and serves as an input to every other framework and indicator to some extent.

The SEEA is closely aligned with this, with the environmental accounts adding physical accounts to the SNA model to include natural capital and an overlap in the principles to convert these into monetary values. SEEA has links, actual or potential, with the majority of environmental and economic indicators listed.

The Wealth accounting approach of the World Bank draws heavily on SNA data but also employs physical accounting and valuation techniques for wealth, some of its own, some aligned with SEEA. It flows directly into the ANS and aNNI indicators, where there is some feedback between them (2 way arrow).

The Ecological Footprint draws on production and consumption data from the SNA, hence the overlap, it also uses variants on physical asset accounting, similar to and now seeking alignment with SEEA.

The Economic of Ecosystems and Biodiversity (TEEB) overlaps with the SNA to the extent that it uses techniques to put monetary value on ecosystems and biodiversity. There is also strong overlap with SEEA, as essentially the SEEA experimental ecosystems module will be developed from TEEB and other sources.

Other highlights the other economic, social and environmental methodologies used, many of these crossing over with SNA data and/or employing physical or monetary accounts as in SEEA. The other methods are particularly relevant to many of the broader social indicators listed.

WAVES is included as an implementation platform, with links to the wealth accounting accounting approach of the World Bank, as the programme parent, TEEB through testing ecosystem accounting and the SEEA as it is aligned and testing principles of economic environmental accounting and is contributing to the development of the experimental ecosystem accounts (2-way arrow). The indicators from WAVES are yet to be selected and therefore many of those listed could be derived.

Green growth frameworks and indicators: links & relationships

Frameworks

Indicators

Implementation

Economic accounting – assets: stocks & flows

System of National Accounts (SNA)

Wealth accounting (World Bank)

Monetary accounting – assets: valuation of stocks and flows   Ecological Footprint

TEEB

SEEA

Other

Physical accounting – natural assets: stocks and flows

China

WAVES

Botswana

National Accounts - GDP

Green GDP

OECD Green Growth

Adjusted Net Saving (ANS) & adjusted Net National Income (aNNI)

Ecological Footprints

UNEP GEI

OECD Green Growth

Broader indirect Indices and indicators – MDG, SSI, ISD, YBLI

Indirect environmental Indices and indicators – EPI

Indirect social indices and indicators – HDI, ISD, Gender Equity, SIGI, MPI

Green growth frameworks and indicators: organisational links & relationships

KEY

| Organisation | Framework / concept | Green growth indicator | Other indicator |

UN

- UNSD
- UNEP
- UNDP
- **System of National Accounts (SNA)**
- SEEA
- Green Economy Initiative (GEI)
- Millenium Development Goal (MDG) indicators
- Human Development Index (HDI)

World Bank

- **Wealth Accounting**
- adjusted Net National Income (aNNI)
- Adjusted Net Saving (ANS)
- WAVES

OECD

- **Green Growth**
- Green growth indicators
- Your better life index
- Social Institutions and Gender Index (SIGI)

National Govt's

- All
- China
- Botswana
- Green GDP type
- Resource accounting type
- Environmental Economic Accounts
- National accounts

Others

- EC
- IMF
- NGO's & other
  - OHPI
  - Erasmus Uni
  - Social Watch
  - SSF
- GFN
- **Beyond GDP**
- **TEEB**
- **Ecological Footprint**
- Ecological footprint
- Indices of Social Development (ISD)
- Multidimensional Poverty Index (MPI)
- Gender Equity Index
- Sustainable Society Index (SSI)

Survey of green growth / environmental sustainability accounting and indicators

Organisational links and alignment

The organisational links follow similar lines to the framework-indicator links, and with bodies such as the OECD, IMF, EU and national governments and agencies playing important roles.

 The UN and its statistical division (UNSD) takes the role of setting the main frameworks for both the system of national accounts (SNA) that is agreed and used internationally, and the System of Environmental Economic Accounts (SEEA), of which the latest version is being revised. Both these frameworks are important internationally and all of the organisations highlighted in the figure engage, to varying extents, with this process.

As described previously the SEEA is to form an underpinning methodology for all integrated economic and environmental accounting. The other organisations are each working to test and design specific methodological elements, with feedback between the two, in the form of the SEEA methodologies borrowing from existing practice and organisations aligning their work and indicators to the SEEA.

The UN only directly produces the GEI indicators, via UNEP, with a more specific interest in wider sustainability in the form of the MDGs and HDI, via UNDP. These organisations do work with others, including NGOs, to develop further indicators, though primarily for indirect indicators.

The World Bank has led on developing the Wealth of Nations framework, which underpins the indicators of aNNI, ANS, which integrate natural capital accounting.

The OECD is also highly active in the area of green growth, although primarily from a policy implementation and monitoring perspective. Its green growth indicator set builds on existing indicators and measures, rather than developing many new measures. The OECD also plays an important role in developing indirect indicators, in partnership with national governments and NGOs.

National governments are engaged across all these issues and some have developed their own specific green growth, resource use or natural capital accounting systems. China and Botswana are highlighted as two examples of this.

Other institutions and players are also highly active in the area of green growth. Perhaps the most active is the European Commission, which has launched its own Beyond GDP initiative to bring together thinking in this area and work towards new indicators.

ECORYS

Independent work is carried out by a variety of NGOs and academic institutions, many of which have developed their own indicators and measures. The highest profile measure of this type is the Ecological Footprint produced by the Global Footprint Network. This has an independent methodology, although efforts are being made to align this with the SEEA accounts system for consistency and timeliness.
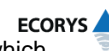
3.5   Gaps identified in the indicator frameworks / indicators

Between the 5 major frameworks the main aspects of environmental sustainability are all taken into account. The extent to which each aspect is taken into account varies across the indicators with the following identified as some of the major gaps / issues:

- **Biodiversity only weakly covered by the frameworks / indicators –** in some respects this is natural as the science and methodologies to account for nature in this way are not well

developed and biodiversity is poorly suited to monetary valuation. The TEEB approach offers the best framework to date, which is beginning to be implemented in some countries, including potentially through the WAVES programme. Other indicators, such as the MDGs do try to address biodiversity although the indicators are relatively generic. The SEEA is developing an approach to this as part of its experimental ecosystem accounts and this will build upon previous work by TEEB and others. Overall this remains one of the least developed areas and will require further work.

- **Social sustainability issues not embedded into most frameworks/indicators –** as identified in 3.1 at the definitional level social sustainability was not considered as part of green growth for most indicators. This gap is reflected in the indicators themselves, only the OECD and UNEP GEI indicators offer some coverage in this area. The indirect indicators can serve as a bridge to this dimension and the range and coverage of these indicators is significant.

- **Consumption and production –** not necessarily a gap but all of the main frameworks and indicators except the Ecological Footprint indicator start from, or have a predominately production perspective to accounting for environmental sustainability. The SEEA, through its physical use accounts, does also track consumption of environmental assets, and so consumption indicators can be drawn from it, this is part of how a link to the EF can be made. The problems with only taking a production approach were elaborated in section 3.2.4 but include that they reflect poorly on producer countries, can be based on production goods for which there are no prices, do not necessarily reflect real changes in income and wealth and only poorly incorporate social and cultural aspects such as quality, access and equality, whereas a consumption approach, supported by other measures can better meet these aims.

- **Quality aspects –** common to most accounting frameworks the indicators here also only weakly cover quality, reducing assets to a simple value that is grown or depleted. This misses the qualitative differences that exist. This is perhaps most evident in the World Bank ANS approach and its consideration of educational investment, the important assumption of investment equating to outcome is questionable.

- **Data, valuation and assumptions –** as a general point across the frameworks and indicators there remain considerable data gaps and inconsistencies. Where these are not immediately apparent it is typically because assumptions have been made, some of which can be quite crucial and questionable, for example on discount rates and asset lifetimes in the ANS approach. This is also relevant to valuation, while techniques and data for this have advanced considerably there remain issues in how natural assets can and are assigned monetary values and if market values fully capture the value of the asset.

- **Between the SNA and the environmental sector –** a gap quite specific to the SEEA but also applicable to defining specific subsets of green growth is the weak alignment between the SNA and its standard industrial classifications (ISIC), and environmental sectors, expenditure and outcomes.

- **Substitutability of environmental assets –** this is a weakness of many of the frameworks, this can lead to a gap in terms of delivering sustainability across all environmental dimensions and is possible as most frameworks allow for poor performance in one area to be compensated by better performance in another.

Geographical coverage

The following table presents a summary of the availability of the indicators geographically across the DfID priority countries and G20. This shows comprehensive coverage for the majority of indirect indicators, except for the OECD Your Better Life Index, but much weaker coverage for the direct indicators of green growth. For the direct indicators only the GFN – Ecological Footprint and World Bank – ANS/aNNI indicators have wide coverage at present.

Table 5 Geographical coverage of direct and indirect green growth indicators / frameworks

	>Indicators	SEEA	WB - ANS	WAV ES	GFN - EF	GEI	MPI	MDG	YBLI	ISD	HDI	SSI	SIGI	GEI
DfID Priority countries	Afghanistan	-	X	-	X	-	-	X	-	X	X	-	X	X
	Bangladesh	-	X	-	X	X	X	X	-	X	X	X	X	X
	Burma	-	X	-	X	X	X	-	-	X	-	-	X	X
	DR Congo	-	X	-	X	X	X	X	-	X	X	X	X	X
	Ethiopia	-	X	-	X	X	X	X	-	X	X	X	X	X
	Ghana	-	X	-	X	-	X	X	-	X	X	X	X	X
	India	-	X	-	X	X	X	X	Soon	X	X	X	X	X
	Kenya	-	X	-	X	X	X	X	-	X	X	X	X	X
	Kyrgyzstan	-	X	-	X	-	X	X	-	X	X	X	X	X
	Liberia	-	X	-	X	-	X	X	-	X	X	X	X	X
	Malawi	-	X	-	X	-	X	X	-	X	X	X	X	X
	Mozambique	-	X	-	X	-	X	X	-	X	X	X	X	X
	Nepal	-	X	-	X	X	X	X	-	X	X	X	X	X
	Nigeria	-	X	-	X	-	X	X	-	X	X	X	X	X
	Occupied Palestinian Territories	-	-	-	X	-	X	X	-	-	X	-	X	-
	Pakistan	-	X	-	X	-	X	X	-	X	X	X	X	X
	Rwanda	-	X	-	X	X	X	X	-	X	X	X	X	X
	Sierra Leone	-	X	-	X	-	X	X	-	X	X	X	X	X
	Somalia	-	X	-	X	-	X	X	-	X	X	-	X	X
	South Africa	-	X	-	X	-	X	X	Soon	X	X	X	-	X
	Sudan	-	X	-	X	-	-	X	-	X	X	X	X	X
	South Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tajikistan	-	X	-	X	-	X	X	-	X	X	X	X	X
	Tanzania	-	X	-	X	X	X	X	-	X	X	X	X	X
	Uganda	-	X	-	X	X	X	X	-	X	X	X	X	X
	Yemen	-	X	-	X	-	X	X	-	X	X	X	X	X
	Zambia	-	X	-	X	-	X	X	-	X	X	X	X	X
	Zimbabwe	-	X	-	X	-	X	X	-	X	X	X	X	X
G20 countries not on DfID priority list	Argentina	-	X	-	X	-	X	X	-	X	X	X	-	X
	Australia	X*	X	-	X	-	-	-	X	X	X	X	-	X
	Brazil	X*	X	-	X	X	X	X	-	X	X	X	X	X
	Canada	X*	X	-	X	-	-	-	X	X	X	X	-	X
	China	X*	X	-	X	X	X	X	-	X	X	X	X	X
	EU	-	-	-	-	-	-	-	-	-	-	-	-	X
	France	X*	X	-	X	-	-	-	X	X	X	X	-	X
	Germany	X**	X	-	X	-	-	-	X	X	X	X	-	X
	India	-	X	X	X	X	X	X	-	X	X	X	X	X
	Indonesia	X*	X	-	X	-	-	X	-	X	X	X	X	X
	Italy	X*	X	-	X	-	-	-	X	X	X	X	-	X
	Japan	X**	X	-	X	-	-	-	X	X	X	X	ECORYS	X
	Mexico	X**	X	-	X	-	X	X	X	X	X	X	-	X
	Russia	-	X	-	X	-	X	X	-	X	X	X	X	X
	Saudi Arabia	-	X	-	X	-	X	X	-	X	X	X	X	X
	South Africa	-	X	-	X	-	X	X	-	X	X	X	-	X
	South Korea	X**	X	-	X	-	-	-	X	X	X	X	-	X
	Turkey	-	X	-	X	-	X	X	X	X	X	X	-	X
	UK	X*	X	-	X	-	-	-	X	X	X	X	-	X
	US	X**	X	-	X	-	-	-	X	X	X	X	-	X

X*   used SEEA guidelines to develop national environmental economic accounting reports and systems

X**   adopted various aspects of the SEEA, but not all components are included

References

Ecorys, 2011. EU industry in a sustainable growth context

EC, 2008, Potential of the Ecological Footprint for monitoring environmental impacts from natural resource use.

Emerson, J.W., A. Hsu, M.A. Levy, A. de Sherbinin, V. Mara, D.C. Esty, and M. Jaiteh, 2012. 2012 Environmental Performance Index and Pilot Trend Environmental Performance Index. New Haven: Yale Center for Environmental Law and Policy

Ewing, B, Moore, D, Goldfinger, S, Oursler, A, Reed, A, and Wackernagel, M. 2010. The Ecological Footprint Atlas 2010. Oakland, Global Footprint Network.

Ewing, B., Reed, A., Galli, A., Kitzes, J., and Wackernagel, M. 2010. Calculation Methodology for the National Footprint Accounts.

Hamilton, K., and Ley, E. 2010. Measuring National Income and Growth in Resource-Rich, Income-Poor Countries.

HM GOV, 2011. Enabling the Transition to a Green Economy: Government and business working together

NL CBS, 2011. Green growth in the Netherlands

OECD, 2011. Towards Green Growth.

OECD, 2011. Towards Green Growth: Monitoring Progress. OECD Indicators.

Statistics Division/ Department of Economic and Social Affairs, United Nations, 2012. Revision of the System of Environmental – Economic Accounting (SEEA).

Stiglitz, J. E., Sen, A., and Fitoussi, J.-P. 2009. Report by the Commission on the Measurement of Economic Performance and Social Progress.

Thiry, G., and Cassiers, I. 2010. Alternative Indicators to GDP: Values behind Numbers Adjusted Net Savings in Question. Discussion Paper 2010-18.

Thiry, G., and Cassiers, I. 2010. Alternative Indicators to GDP: Values behind Numbers Adjusted Net Savings in Question.

UN WCED, 1987. Our Common Future

UN, 2008. System of National Accounts 2008

UN, 2010. Fifth Meeting of the UN Committee of Experts on Environmental-Economic Accounting New York, 23-25 June 2010.

UN, 2012. Documents for the forty-third session of the Statistical Commission New York, 28 February to 2 March 2012.

UN UNSD – London Group, 2011. SEEA experimental ecosystem accounts: a proposed outline, roadmap and issues

UN, EC, IMF, OECD, and World Bank, 2003. Integrated Environmental and Economic Accounting.

UNCEEA, 2010. Harmonizing the National Footprint Accounts with the System of Integrated Environmental and Economic Accounting.

UNEP 2011. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication.

UNEP, 2003. Strategy Paper on Environmental Indicators.

UNEP, 2011. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication.

Wackernagel, M., and Rees W. E. 1996. Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island, Canada: New Society Publishers.

Watts, J. 2011. China's green economist stirring a shift away from GDP. The Guardian.

Wiedmann, T., and Barrett, J. 2010. A Review of the Ecological Footprint Indicator - Perceptions and Methods. Sustainability, Vol. 2, p. 1645-1693.

ECORYS

World Bank data: time series of ANS 1980-2008
http://siteresources.worldbank.org/EXTEEI/Resources/ANS_time_series_by_country_1970to2008.xls.

World Bank, 2011. The Little Green Data Book.

Yale University, 2012. Environmental Performance Index - available at http://epi.yale.edu/

ECORYS ▲ Survey of green growth / environmental sustainability accounting and indicators

P.O. Box 4175

3006 AD Rotterdam

The Netherlands

Watermanweg 44

3067 GG Rotterdam

The Netherlands

T +31 (0)10 453 88 00

F +31 (0)10 453 07 68

E netherlands@ecorys.com

W www.ecorys.nl

Sound analysis, inspiring ideas