Measuring Ireland's Sustainability

Measuring sustainable development: the integration of environmental data into macroeconomic models

Working Paper

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1. Introduction.

The establishment of a more sustainable pattern of development is one of the key challenges for Government. Achieving the aim of moving any modern European economy onto a sustainable footing will be a process of managed change, comprising of target setting, policy development and implementation, and monitoring and evaluation of progress towards targets through a comprehensive set of indicators.

Sustainable development policy is evolving at both the European and national level with the adoption of the revised EU Sustainable Development Strategy in June 2006 which sets out how the EU plans to be more effective in meeting the challenges of sustainable development and focuses on the key objectives of environmental protection, social equity and cohesion, economic prosperity and meeting international responsibilities. Ireland is currently in the process of revising its National Sustainable Development Strategy (NSDS) and '*Towards 2016*'[1], the national partnership agreement not only commits the Government to a review of the NSDS but to examine the application of satellite accounts in the area of environmental sustainability.

Ireland has had a sustainable development strategy in place since 1997[2] which was reviewed in 2002[3] but has not yet adopted a sustainable development indicator (SDI) set. The Central Statistics Office (CSO) first published an initial set of national progress indicators in 2003 in response to a specific request in '*Sustaining Progress*'[4]. With the exception of the CSO *'Measuring Ireland's Progress'* series of reports there has been little progress in the development and application of a SDI set for Ireland.

Previous research commissioned by Comhar on SDIs, '*Counting What Counts*' identified the range of indicators currently available for Ireland and significant gaps[5]. However the review also identified the need to put in place the framework from which many sustainable development indicators can be derived, namely a system of integrated economic and environmental accounting.

1.1 The aim of this Working Paper.

The aims of this paper are to build on the review of SDIs and provide an overview of Ireland's performance on sustainable development and to provide recommendations on the development of satellite accounts for sustainability and a SDI set. The challenge of how to effectively implement Ireland's sustainable development agenda is the topic of the Comhar annual conference and this working paper will contribute to the discussions and outline the role of measurement and indicators in underpinning and informing policy implementation.

1.2 What are Satellite Accounts and how do they link to Sustainable Development Indicators?

The United Nations System of National Accounts (SNA) provide consistent and coherent data sets and indicators for economic policy analysis, however the standard SNA is too restricted with respect to environmental research questions and monetary accounting alone will not reflect the social costs of depleting or deteriorating natural resources. Satellite accounting systems extend

[1] Department of the Taoiseach (2006) Towards 2016, Ten-Year Framework Social Partnership Agreement 2006-2015. Available on http://www.taoiseach.gov.ie/index.asp?locID=181&docID=2755.
[2] DOEHLG (1997) Sustainable Development: A Strategy for Ireland.
[3] DOEHLG (2002) Making Ireland's Development Sustainable: Review, Assessment and Future Action.
[4] Department of the Taoiseach (2003) Sustaining Progress. Social Partnership Agreement 2003-2005.
[5] Maguire, C. & Curry, R. (2007) Counting What Counts. A review of sustainable development indicators for Ireland. Comhar research paper.

the scope of the SNA either through supplementary environmental accounting or adjusting accounting conventions. Satellite accounts have been developed in fields such as public health, tourism and transport but the environmental accounts and in particular the National Accounting Matrix including Environmental Accounts (NAMEA) is one of the most well developed satellite systems to the SNA (Pederson and de Haan, 2006)[6].

One of the major benefits of linking satellite accounts to national accounts is that it enables the derivation of a range of indicators, mainly economic and environmental in a standardised way. Indicators have been defined by EuroStat in a recent review as[7]:

> *'An indicator is a parameter, or a value derived from a set of parameters, that points to, provides information about and/or describes the state of a phenomenon. It has significance beyond that directly associated with the parameter value.'*

Therefore, an indicator is a measure of activity, which can be used to compare the performance of this activity against targets, aims and objectives. As sustainable development seeks to integrate environmental protection, economic growth and social progress, a SDI set needs to provide a complete picture of our socio-economic-environmental system in an integrated and holistic way. While an integrated system of economic and environmental accounting will provide many of the indicators that comprise the SDI set, these will need to supplemented with indicators that address the social dimension and other challenges in more detail. Further discussion of satellite accounts is given in Section 5.

1.3 The Role of Satellite Accounts and Indicators in Sustainable Development.

Satellite accounts and an integrated system of economic and environmental accounting form the framework that permits a consistent analysis of the contribution of the environment to the economy and the impact of the economy on the environment, whereas the indicator set provides information for decision makers and measures progress against objectives. The contribution of indicators to the SD decision making process is represented in Figure 1. This is an iterative process and indicator sets are subject to revision over time to reflect changing policy priorities.

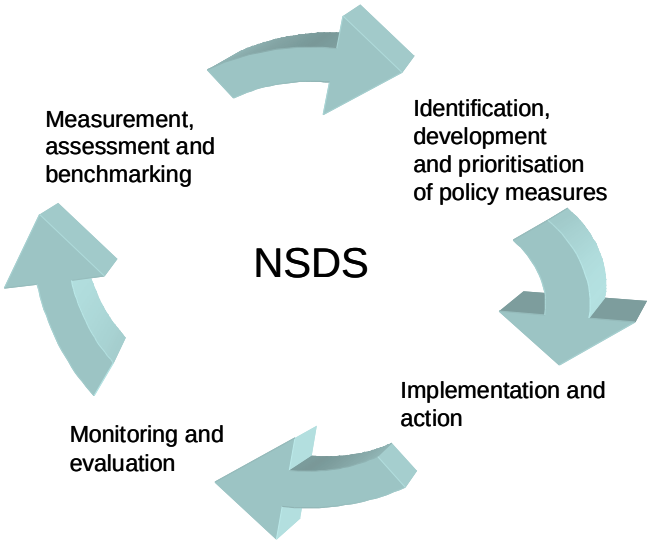

Figure 1: Indicators and their role in sustainable development policy

[6] Pedersen, O. and de Haan, M. (2006) The System of Environmental and Economic Accounts–2003 and the Economic Relevance of Physical Flow Accounting. Journal of Industrial Ecology 10(1-2): 19-43.
[7] EU Member State Experiences with Sustainable Development Indicators. Statistical Office of the European Communities (EUROSTAT). 2004. ISBN 92-894-5054-1.

Having the right accounting framework and indicator set in place will underpin the implementation of the revised NSDS. The indicator set will measure progress towards sustainable development at a range of levels from the strategic through to detailed policy implementation and analysis.

Comhar has identified eight key challenges for sustainable development which incorporate the seven key challenges identified in the revised EU SDS[8]:

- Climate change and clean energy
- Sustainable transport
- Sustainable consumption and production
- Conservation and management of natural resources
- Public health
- Social inclusion, demography and migration
- Global poverty and sustainable development strategies
- Spatial planning

Comhar has also identified four cross-cutting themes relating to governance; policy integration; fiscal and macroeconomic measures; and communication, awareness and education for sustainable development that need to be addressed in the revised NSDS. The eight key challenges (coupled with economic development which is not identified as a key challenge but is a part of sustainable development) need to be addressed by an indicator set. This enables benchmarking and communication of progress on each of these challenges and where this is lacking, reporting on indicators can drive increased effort towards meeting sustainable development targets.

1.4 Objectives of the working paper.

The Department of Environment, Heritage and Local Government (DEHLG) has committed to an updated NSDS being published in 2008. This working paper is intended to inform the input of Comhar to this process, in particular, recommendations on addressing the challenge of implementing sustainable development in Ireland. The specific objectives of the research are:

- Provide an overview of available data sources for Ireland's performance on sustainable development.
- Provide an overview of Ireland's performance on sustainable development according to available data.
- Provide an overview of the gaps in national statistics/data.
- Provide recommendations on how satellite accounts for sustainability could be developed in Ireland.
- Provide recommendations for a full set of sustainable development indicators using an indicator pyramid which enables the prioritisation of the use of the indicators according to their use.

This working paper is prepared in the context of the Comhar recommendations on monitoring and measuring sustainability, namely;

- An appropriate set of SDIs should be published with the revised NSDS to provide a basis of measuring progress on sustainability and a means to effectively communicate this to the general public.
- A hierarchical approach to SDIs should be used enabling the indicators to inform decision-making, benchmark and measure progress over time and measure the implementation of the strategy.

[8] Comhar SDC position paper. Recommendations on the review of the National Sustainable Development Strategy. 27 September 2007. Available at www.comharsdc.ie

- The SDI set should incorporate relevant indicators that are already used by the European Union to minimise duplication of effort by statistical agencies in collecting and analysing data and the development of the indicator set should be adequately resourced.

The recommendations contained within this working paper will provide a basis for discussion on measuring and monitoring sustainable development in Ireland. However, as emphasised in '*Counting What Counts'* the NSDS and SDI set should be progressed together and a public consultation carried out for both in parallel, as any suggested SDI set will be subject to change depending on the final content of the NSDS.

2. An overview of available data sources for Ireland's performance on sustainable development.

The review undertaken in '*Counting What Counts'* identified a wide range of available data sources for Ireland's performance on sustainable development including those relating to aggregated socio-economic-environmental indicators and the following key publications or publication series:

- Environmental Protection Agency – Environment in Focus Series
- Environmental Protection Agency – Ireland's Environment 2004
- Central Statistics Office – Measuring Ireland's Progress Series
- Central Statistics Office – Principal Statistics
- National Economic and Social Council – Strategy 2006: People, Productivity and Purpose

The EPA and the CSO are the main data providers relating to sustainable development in Ireland. Another key source of information is Sustainable Energy Ireland (SEI) with their Energy Policy Statistical Support Unit whose core functions include the development and dissemination of appropriate sustainability indicators[9].

The EPA is the most significant provider of statistical data on the environment and their publications cover an extensive range. The funding by the EPA of an Environmental Research Centre Fellowship to develop a time series of material flow data will play an important role in contributing to the institutionalisation of material flow accounting. Data sets compiled by the CSO such as ProdCom sales (Products of the European Community) and trade statistics form the basis of Material Flow Accounts (MFA) although they also use data from other data providers such as Coford (forestry), Bord Iascaigh Mhara (aquaculture production), Fisheries Research Centre (inland fisheries) and the EPA (GHG emissions and waste).

EPA research reports cover a wide range of areas relating to sustainable development and the emphasis in the Science, Technology, Research and Innovation for the Environment (STRIVE) programme 2007-2013 on sustainable development and well-being will add to the evidence base in this area. The recently issued call for sustainable development and environmental socio-economic research identified measurement and evaluation as a main theme and potential research opportunities identified were:

- Sustainability and environment in national accounts - building on work already underway to extend national accounts to include environmental quality, natural resources and externalities.
- Sustainability indicators - operationalising indicator sets, communicating indicators, linking indicators and dynamic modelling.
- Evaluating the performance of policies and programmes.

The outputs of this research will be important in informing further development of a SDI set and benchmarking Ireland's performance in the coming years.

[9] Sustainable Energy Ireland (2006) Energy Statistics 1990-2005.

There are a range of indicators which are calculated for Ireland such as the Human Development Index (HDI), Environmental Sustainability Index (ESI), Environmental Vulnerability Index (EVI) and Ecological Footprint (EF) which are not part of the EU SDS dataset. Data used in calculating these indicators is primarily derived from international statistics held by the United Nations Statistical Division supplemented with data from national statistical agencies. Calculation of the Ecological Footprint for over 150 countries including Ireland is carried out by the Global Footprint Network.

Indicators which were not part of the previous review and are currently being assessed at EU level in the context of supporting the Thematic Strategy on the Sustainable Use of Natural Resources in combination with the Ecological Footprint include Environmentally Weighted Material Consumption (EMC), Human Appropriation of Net Primary Production (HANPP), Land Use Accounting (LUA) and Land and Ecosystem Accounts (LUAC).

Information used to calculate these indicators for the EU member states is held by a variety of organisations such as the European Environment Agency (LUA and LUAC), University of Leiden (EMC)[10] and the Institute of Social Ecology at Klagenfurt University (HANPP)[11].

3. Ireland's performance on sustainable development according to available data.

Ireland's performance on sustainable development as measured by a selection of the headline indicators in Table 4 has been benchmarked against the EU averages (EU-27, EU-25, EU-15 where available) and a small number of countries in a series of graphs contained in Annex 1. Finland and Denmark were chosen as they are viewed as having high standards of development and environmental protection and Finland in particular has similar natural resource use to Ireland, and the UK because of the all-island dimension.

These indicators were chosen as they are the recommended set of headline indicators and cover the range of challenges identified by Comhar with the exception of spatial planning where no comparable data was available. In summary the graphs show that Ireland is performing well in economic terms but less so in environmental and social ones. Ireland's performance in each of the Comhar challenges is outlined in more detail below.

3.1 Economic development

Balanced economic development is a key part of sustainable development and Figure A shows the growth rate of GDP per capita. The calculation of the growth rate of the GDP per capita enables comparison of the dynamics of economic development both over time and between economies of different sizes and is a Level 1 indicator in the EU SDI set. Figure A shows Ireland has had a high growth rate of GDP per capita compared to the EU averages, Finland, Denmark and the UK from the early nineties onwards. The difference has decreased since 1999, although Ireland still remains above the EU averages and similar to both Finland and Denmark.

[10] Van der Voet, E, van Oers,L., Moll, S., Schütz, H., Bringezu, S., de Bruyn, S., Sevenster, M., Warringa, G. (2005): Policy Review on Decoupling: Development of indicators to assess decoupling of economic development and environmental pressure in the EU-25 and AC-3 countries. CML report 166, Leiden: Institute of environmental sciences (CML), Leiden: Leiden University, Department Industrial Ecology, 2005 (download: http://www.leidenuniv.nl/cml/ssp/projects/dematerialisation/policy_review_on_decoupling.pdf)

[11] Helmut Haberl, Karl-Heinz Erb, Fridolin Krausmann, Veronika Gaube, Alberte Bondeau, Christof Plutzar, Somone Gingrich, Wolfgang Lucht and Marina Fischer-Kowalski. 2007. Quantifying and mapping the global human appropriation of net primary production in Earth's terrestrial ecosystem. Proceedings of the National Academy of Sciences of the USA. 104: 12942-12947.

3.2 Climate change and clean energy

Climate change is a global problem and each country needs to take action domestically to reduce their greenhouse gas (GHG) emissions. Decoupling economic activity from emissions of greenhouse gases will require a major shift in Ireland's energy mix and improved energy efficiency and is a fundamental requirement of sustainable development. Figure B clearly shows the upward trajectory of Ireland's emissions and the gap between emissions and the Kyoto target. The total emissions are presented as indices and Ireland has higher emissions than the EU average and the other countries shown highlighting the scale of the challenge to reduce emissions domestically, although Finland also has increasing emissions. The greatest rise in emissions has been in the transport sector and the recent commitment to an annual 3% reduction in emissions and implementation of policy measures to reduce GHG emissions will be reflected by changes in this indicator.

3.3 Sustainable transport

A sustainable transport system should contribute to economic development and social welfare without causing damage to the environment or harm to human health. In Ireland, the transport sector shows the greatest increase of GHG emissions at 160 per cent between 1990 and 2005. This increase is mainly due to the rising number of vehicles on the roads, the reliance on private vehicles, particularly for the commute to and from work and the trend towards purchasing larger vehicles (EPA, 2007). The total energy consumption of transport covers all transportation modes including road, rail, air and inland navigation. Figure C shows the dramatic rise in total energy consumption of transport in Ireland compared to the EU averages and other countries indicating the scale of the challenge to move towards more sustainable transport patterns.

3.4 Sustainable consumption and production

Production and consumption patterns are at the heart of sustainable development and Comhar has recommended that a national sustainable consumption and production (SCP) action plan be produced. The indicators shown in Figures D-G show both the amount of materials consumed in Ireland and the ecological pressure associated with that level of consumption. Figure D shows Direct Material Input (DMI) which measures the direct input of materials (in terms of their mass) for use into the economy i.e. all materials which are of economic value and are used in production and consumption activities and DMI equals domestic extraction plus imports. In Ireland DMI per capita is high but has remained so over the course of significant economic growth. This reflects relative decoupling but Ireland still has a significantly higher materials burden than in other EU countries with the exception of Denmark and Finland. This reflects the relative importance of materially intensive sectors of the economy such as pasture based agriculture in Ireland and forestry in Finland.

Domestic Material Consumption (DMC) shown in Figure E measures the total amount of material used directly in the economy and equals DMI minus exports. This is a Level 1 indicator in the EU SDS and shows that Ireland has the second highest DMC per capita in the EU-15 reflecting a stronger link between economic activity and resource consumption than in other EU counties. The ecological pressure associated with this consumption is shown in Figure F as indicated by the Ecological Footprint. The Ecological Footprint (EF) is the total area required to produce the resources a country consumes, absorb the wastes that it generates and provide area for its infrastructure. Ireland has a similar EF to the UK and is above the European averages and so improvements could be made in both how efficiently Ireland uses resources and overall levels of consumption. Ireland's EF has been increasing since 1961 while the amount of global biocapacity or biologically productive area available per capita has been decreasing as shown in Figure G. This indicates that if everyone consumed resources at the same level as an average Ireland resident, over three earths would be needed and Irish residents are not living within the ecological limits of the planet.

3.5 Conservation and management of natural resources

Economic development must go hand in hand with the sustainable use of natural resources and maintenance of biodiversity and ecosystems. These provide the ecological goods and services

which are the life support system for humanity. Of particular concern is the decline in resources that are impossible to replace such as biodiversity. There is currently no single indicator of biodiversity and the indicator shown in Figure H is an aggregated index of population trend estimates of a selected group of breeding bird species which are dependent on agricultural land for nesting or feeding. Although data for Ireland is only available since 1998, there has been improvement since then and Ireland performs better than the EU average and the other countries shown.

3.6 Public health

There are both positive and negative trends shown by the indicators selected for public health. Good health is an outcome of many factors including a clean environment, good diet, poverty reduction and provision of health care. This can be measured by the number of healthy life years from birth. Figure I show that in Ireland the number of healthy life years for both males and females is below the EU average although higher than the other countries shown. Healthy life years for males have not changed much since 1995, although there has been a gradual reduction in healthy life years for females since it has been measured. This demonstrates that good economic performance has not coincided with an improvement in public health as measured by this indicator.

The Human Development Index (HDI) is a widely used measure of national development and is a composite of four sub-indicators: life expectancy at birth, adult literacy rate, gross school enrolment ration and per capita GDP. This measures the average achievements in a country in three basic dimensions of human development namely a long and healthy life, knowledge and a decent standard of living. Figure J shows the increasing trend in the HDI for Ireland since 1975 and Ireland is now above the EU average and ranked fourth in the world.

In terms of public health, a topical issue is the level of alcohol consumption. Figure K shows that alcohol consumption in both Ireland and the UK is increasing whereas the EU average is decreasing and this has impacts on public health and services provision.

3.7 Social inclusion, demography and migration

Reducing poverty and social inclusion is central to sustainable development. Poverty has a high social cost and can also be borne disproportionately by certain sections of society. Figure L shows the total at-risk-of-poverty rate after social transfers (which is the share of people with an equivalised disposable income below the risk-of-poverty threshold which is set at 60% of the national mean equivalised disposable income after social transfers) and shows that during a period of strong economic performance there was no reduction in the at-risk-of-poverty rate which remains higher than the EU average and the other countries shown.

Demographics are also changing and this has economic and social implications and therefore implications for sustainable development and well-being. Figure M shows the projected rise in the old age dependency ratio for Ireland given current trends although this remains below the EU averages. This is the ratio of the number of elderly persons over 65 and persons of working age and this trend is driven by people living longer and a lower birth rate.

3.8 Global poverty and SDS

Ireland has recently committed to increasing official development assistance to 0.7% of gross national income by 2012. Figure N shows that Ireland's overseas development assistance (ODA) has been increasing since 1990 but it remains lower than the EU average and further improvement needs to be made to reach the 2012 target.

4. Overview of the gaps in national statistics/data.

'*Counting What Counts*' gave an overview of the range of social, economic and environmental indicators for Ireland and while there are a large number of indicators available, the extent to which they address trends in sustainable development is questionable. The report also identified which indicators currently published for EU member states are not currently published for Ireland or where estimated data has been used. The full gap analysis is not repeated here and in summary, significant data gaps were identified relating to the themes of 'production and consumption patterns', 'management of natural resources', 'transport' and 'public health' where it relates to environmental factors. These are four of the key challenges identified by Comhar and so the development of any SDI set which addresses these themes will also need to address the gaps in national statistics and data relating to these themes.

4.1 Production and Consumption and Water

The main gaps in indicators relating to production and consumption have as their underlying framework, Material Flow Accounts (MFA) and waste statistics. One way of addressing this is to compile a National Accounting Matrix including Environmental Accounts (NAMEA) for waste that would improve the detail available at a sectoral level and would also compliment MFA and contribute to their improvement. Further detail on gaps and recommendations for addressing production and consumption indicators and water are given in Section 5 as they relate directly to the development of satellite accounts. A full data gaps and needs analysis has also been carried out for Material Flow Accounts and the Ecological Footprint for Ireland which identified gaps such as data on dissipative outputs to the environment such as pesticide and fertilizer use[12].

4.2 Management of Natural Resources

Although there was no data available for Ireland for most of the EU SDI set relating to management of natural resources, the EPA has published a series of reports on environmental indicators. A number of these could be used as part of the Ireland SDI set to supplement the EU indicators such as designated areas; and endangered, vulnerable and rare species.

4.3 Transport

There was a lack of data on transport indicators in Ireland but there are ongoing developments which will improve data and indicator availability in this area in the coming years. The UN Commission on SDI has recommended that vehicle-km is the best proxy for energy consumption by transport and in response EuroStat are proposing that supply of vehicle-km data becomes mandatory for member states. This will require measurement or estimation of vehicle-km for all modes of transport in Ireland and this can be included as a headline indicator in the SDI set in future years. EuroStat hold data on modal split for passenger and freight transport for Ireland and vehicle-km data also exist for some modes of transport in Ireland including road freight and rail passenger and freight (SEI, 2004)[13]. However the development of a National Transport Survey as recommended by the National Statistics Board would significantly improve data collection and indicators in this area.

4.4 Public Health

The data gaps relating to public health mainly related to environmental factors and EU SDI Level 3 indicators. These include pesticide residues in food, and dioxins and PCB's in food and feed, however in the context of the revised NSDS these may not be considered the best indicators for specific policies.

4.5 Spatial Planning

This is an additional theme proposed by Comhar and as such there are no EU Level 1 indicators relating to spatial planning as this is considered to be an issue for member states. There is a

[12] Curry, R., Maguire, C., Simmons, C., Lewis, K., Moles, R., O'Regan, B. & Walsh, C. (2007) Island Limits. A Material Flow Analysis and Ecological Footprint of Ireland. Environmental Protection Agency.
[13] Sustainable Energy Ireland (2004) Strategies to reduce greenhouse gases from Irish transportation. SEI.

Level 2 indicator 'built up areas' and the EPA also collect data on land use and the CSO on dwelling completions. These have been included in the proposed Ireland SDI set as a basis for discussion, however spatial planning is an area in which further Ireland specific indicators should be developed which best reflect policy priorities.

This is a basic gap analysis and may have missed data held by particular organisations including Universities, and this demonstrates the need to also put in place a structure that facilitates sharing of statistics and data between the main data providers and supports the CSO in taking the lead in compiling and publishing the SDI set. Further details and recommendations on such a structure can be found in Section 5.

5. How satellite accounts for sustainability could be developed in Ireland.

5.1 Introduction

The United Nations System of National Accounts (often abbreviated to SNA[14]) is an international standard system of national economic accounting, first published in 1953. With the increasing prominence of environmental and sustainability issues, the recognition that our society/economy is essentially a sub-system embedded within the environment, and derived from this philosophy, is the view that robust methodologies for measuring the movements of materials and energy from the environment to and from the society/economy system are essential. The economy/environment 'system' is shown in Figure 2.

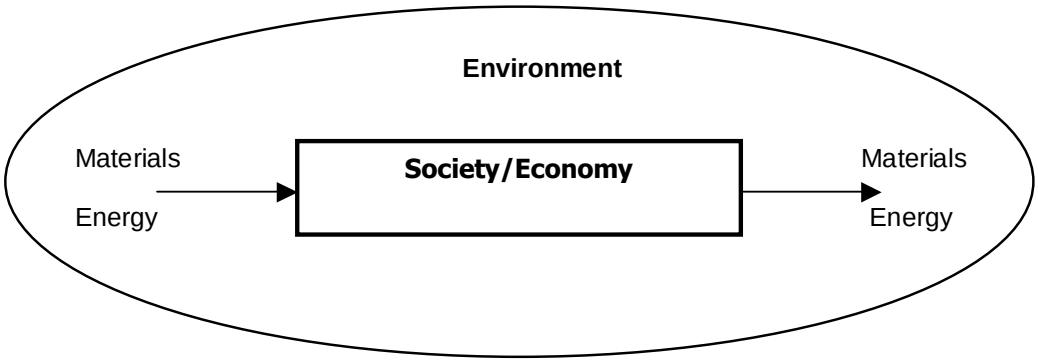

Figure 2: The Economy/Environment System

Pedersen and Haan[15] have stated:

> *The system of national accounts (SNA-1993) provides the world wide macroeconomic accounting standards (CEC et al. 1993). The national accounts provide coherent and consistent data sets and indicators for economic policy analysis. But the standard SNA is too restricted with respect to environmental research questions. Because environmental functions are in many cases available without direct monetary costs incurred by their users, monetary accounting usually will not reflect the social costs of depleting or deteriorating natural resources.*

[14] United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank. (1993). 1993 System of National Accounts.
[15] Pedersen, O and Haan, M. (2006). The System of Environmental and Economic Accounts–2003 and the Economic Relevance of Physical Flow Accounting. Journal of Industrial Ecology. Vol 10, Issue 1-2.

This has led to the development of the *United Nations Handbook of Environmental Accounting – Integrated Environmental and Economic Accounting* (known as SEEA-2003)[16]. SEEA-2003 provides a detailed overview of environmental accounting approaches that have been developed in parallel with the SNA. Expanding the national economic accounts with physical data sets facilitates the joint analysis of environmental and economic policy issues. SEEA-2003 is jointly published by the European Commission/EuroStat, the International Monetary Fund (IMF), the Organisation for Economic Cooperation and Development (OECD), the United Nations (UN), and the World Bank and can be regarded as an international environmental accounting reference book for statistical offices, national governments, and international organizations.

Further work has been undertaken on development of environmental satellite accounts at a European level and a range of methodological manuals on their compilation have been published by EuroStat, which provide conceptual guidelines as well as descriptions of sources and methods used in practice by Member States for the compilation of the data. To date, manuals have been published for the following:

- The European framework for integrated environmental and economic accounting for forests – IEEAF[17]
- Environmental taxes - a statistical guide[18]
- Economy-wide material flow accounts and derived indicators - a methodological guide
- Environmental expenditure statistics - Industry data collection handbook[19]
- OECD/EuroStat Environment Protection Expenditure and Revenue Joint Questionnaire/SERIEE (European System for the Collection of Economic Information on the Environment) Environmental Protection Expenditure Account: Conversion guidelines[20]
- SERIEE - Environmental protection expenditure accounts - compilation guide[21]
- Natural resource accounts for oil and gas[22]

In addition, EuroStat is currently collecting data through standard tables/questionnaires in the following areas:

- Environmental taxes by industry (EuroStat standard table for the data collection of tax payees)
- NAMEA Air (EuroStat data collection on air pollutants by industry and for the households)
- Forest accounts (EuroStat data collection on economic accounts on forestry)
- Subsoil accounts (EuroStat standard tables for the data collection of subsoil asset accounts for oil and gas)
- Water accounts (EuroStat standard table for the data collection of water accounts)

These accounts enable the calculation of a range of indicators and the relationship between the accounts and indicators is outlined below.

[16] United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank. (2003). Integrated Environmental and Economic Accounting.
[17] European Commission. (2002). The European framework for integrated environmental and economic accounting for forests – IEEAF
[18] European Commission. (2001). Environmental taxes - A statistical guide
[19] European Commission. (2005). Environmental expenditure statistics - Industry data collection handbook
[20] European Commission. (2005). OECD/Eurostat Environment Protection Expenditure and Revenue Joint Questionnaire/SERIEE (European System for the Collection of Economic Information on the Environment) Environmental Protection Expenditure Account: Conversion guidelines
[21] European Commission.. (2002). SERIEE - Environmental protection expenditure accounts - Compilation guide
[22] European Commission.(2002). Natural resource accounts for oil and gas

5.2 Why environmental accounts?

'Counting What Counts' described the DPSIR framework (driver, pressure, state, impact, response) and its use in the development and selection of indicators, as set out below:

- Driving forces of environmental change (e.g. industrial production)
- Pressures on the environment (e.g. discharges of waste water)
- State of the environment (e.g. water quality in rivers and lakes) Impacts on population, economy, ecosystems (e.g. water unsuitable for drinking)
- Response of the society (e.g. pollution controls)

The use of the DPSIR framework reemphasises the relationship of economy/society set out in Figure 2, highlighting that the physical exchanges or flows of materials and energy between the environment and the economy are the fundamental drivers which are placing pressure on the environment, further emphasising the need for robust accounting systems which capture these flows. The most consistent and complete means of capturing these flows is physical environmental accounting. The indicators derived from this system will also need to be supplemented with indicators which capture the social impacts which derive from these drivers.

5.3 Indicators, Indices and Integrated Environmental and Economic Accounting.

The development of indicators and/or indices involves the collection and aggregation of data to meet a variety of user needs and application levels. Pedersen and de Haan (2006) discuss how the development of indicators and indices within the SEEA accounting system ensures consistency and transparency when aggregating from basic data through to indicators and composite indices, such as Ecological Footprinting, and set this out in the form of the aggregation and information pyramids, which builds on the EuroStat SD Indicator pyramid in '*Counting What Counts'* (p11) (Figure 3).

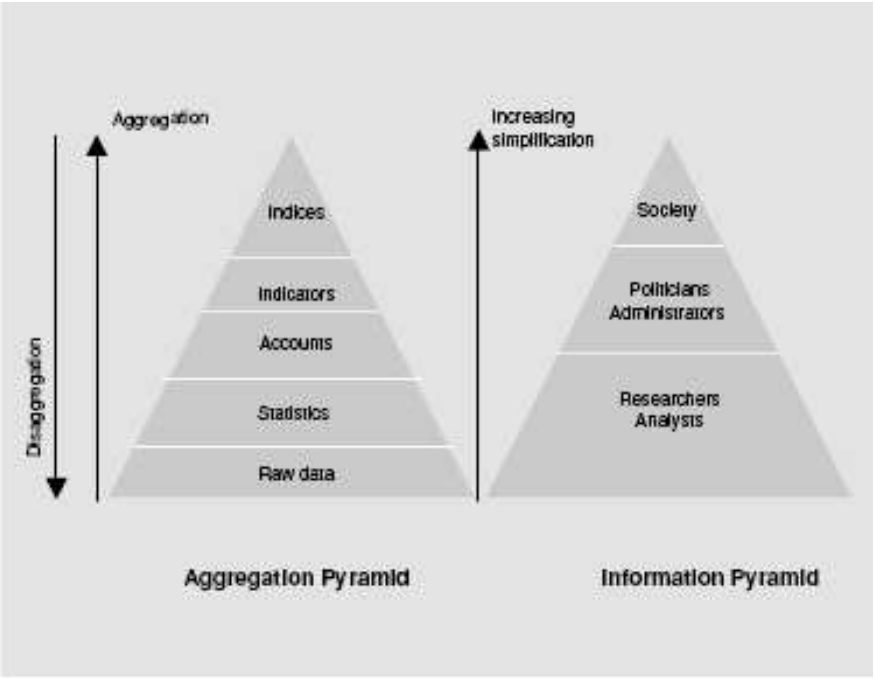

Figure 3: Aggregation and information pyramids.

They go on to describe how employing the accounting procedures set out in the SEEA ensures:

> *'**Vertical** consistency (from the bottom to the top) because the strict definitions and identities of the accounts contribute to binding information at various levels together. The accounts provide users with the possibility of going deeper into the data structure underlying indicators targeting driving forces, pressures and responses. **Horizontal** consistency is also ensured by the accounting structure.'*

5.4 Environmental accounting in Ireland to date

Given the lack of satellite accounts in the social sphere and the focus of EuroStat on standardising environmental accounts, this section comprises a review of environmental accounting in Ireland to date focussed on the following projects:

- Central Statistics Office - Environmental Accounts 1997-2005[23]
- ESRI - ISus (Irish Sustainable Development Model)[24]
- ESRI - Environmentally extended I-O model for Ireland[25]
- EnviroCentre – Economy-wide Material Flow Analysis of Ireland
- EnviroCentre - Environmentally extended I-O model for Ireland[26]

These are reviewed in the light of SEEA 2003 and the methodological manuals produced by EuroStat to identify to what extent environmental accounting in Ireland has developed and recommendations made for the development of integrated environmental accounts which address data gaps and needs and the structures needed to develop such accounts.

Central Statistics Office - Environmental Accounts 1997-2005

The environmental accounts for Ireland present satellite accounts for greenhouse gas emissions and acid rain precursors. The environmental accounts are based on the official estimates compiled and published by the Environmental Protection Agency, combined with a range of other data sources and combining these to attribute air emissions to 19 economic sub-sectors, rather than the physical processes that generate the emissions. The aim of the accounts is described as:

> *'to outline the potential impact on the environment of economic and social activity. The idea is to list in quantifiable terms the amount of potential air pollutants produced by industry and households, which may in turn be compared to the employment and the value of output produced by these sectors.'*

The estimates in the satellite accounts used a methodology based on using data on fuel expenditure and dividing this by average fuel prices and using standard conversion factors to convert fuel quantities consumed into estimates of air emissions. The reports states:

> *The methodology employed, where fuel consumption is inferred from fuel expenditure, is the best available in the absence of sectoral data on quantities of fuel consumption.*

ESRI - ISus (Irish Sustainable Development Model)

This research reviewed the options available for the development of an Irish Sustainable Development Model within the context of the following criteria for a successful model:

- Firstly, it needs to be useful to and used by key policy-makers.

[23] Central Statistics Office. (2007). Environmental Accounts for Ireland 1997-2005.
[24] O'Doherty, J, Mayor, K, Tol, R. (2007). Irish Sustainable Development Model (ISus) Literature Review, Data Availability and Model Design. ESRI Working Paper No. 186.
[25] O'Doherty, J, Tol, R. (2007). An environmental input-output model for Ireland. ESRI ESRI Working Paper No. 178.
[26] Curry, R., Maguire, C., Simmons, C., Lewis, K., Moles, R., O'Regan, B. & Walsh, C. (2007) Island Limits. A Material Flow Analysis and Ecological Footprint of Ireland. Environmental Protection Agency.

- Secondly, it should build on models and research that are already available.

The study presented an analysis of six processes that currently impact on Ireland's environment, an overview of existing economic models that have been used in relation to environment-economy interactions, an analysis of economic evaluation techniques, the environmental data currently available in Ireland, an overview of similar projects elsewhere and an outlines of design issues for the ISus Model.

The study concludes that the prototype ISus would take the form on an environmental input-output model which could be further developed to link with econometric models of the Irish economy.

ESRI - Environmentally extended I-O model for Ireland

This study outlines the results of the construction of an environmental input-output model of the Irish economy for the year 2000 and the use of the outputs of this model combined with historical data to forecast emissions, waste and water use to 2020. The model uses the uses the CSO input-output tables for Ireland 2000, linked to emissions coefficients. The study recommends that the results be treated with caution, stating:

> *'Emission coefficients are here assumed to be static, but in fact respond to structural changes within the economic sectors, technological changes, prices, and environmental policies. Finally, input-output analysis focuses on the production side of the domestic economy. Household pollution and resource use is not included. This particularly affects carbon dioxide, waste and water. Similarly, the environmental impacts of the production of imported goods are excluded.'*

EnviroCentre, Best Foot Forward and University of Limerick – Island Limits: A Material Flow Analysis and Ecological Footprint for Ireland

Funded by the EPA under the Environmental Research Technological Development and Innovation (ERTDI) Programme 2000-2006, the completion of the first economy-wide MFA for Ireland for the year 2003 provided a comprehensive description of the material flows between the environment and the economy as well as within the economy by industrial sector (production and consumption). This has created a sound material accounting framework, which can be built upon to enable Ireland to measure and model its consumption of resources on an ongoing basis. The MFA was compiled using the EuroStat standardised guidance '*Economy-wide material flow accounts and derived indicators. A methodological guide*'[27], and as such, is fully compatible with the SEEA 2003.

EnviroCentre - Environmentally extended I-O model for Ireland

Building on the outputs of the Material Flow Analysis for Ireland, environmentally extended input-output tables were constructed to enable the modelling of the flows of products within the economy and the estimation of the physical amount of natural resource inputs required by domestic industry to meet the final demand of Irish households and products for export. The model uses the uses the CSO input-output tables for Ireland 2000. This model could be further improved with better refinement of the allocation of imports to economic sectors and could be combined with the ISus model to combine material inputs and environmental outputs into one environmentally extended input-output model.

The review of environmental accounting projects and programmes in Ireland to date has demonstrated the significant progress that has been made in recent years in areas such as satellite accounts for greenhouse gas emissions and acid rain precursors, environmentally extended input-output analysis and economy-wide material flow analysis. However, currently satellite accounts for Ireland are limited to the existing satellite accounts described above.

[27] EuroStat. (2002). Economy-wide material flow accounts and derived indicators. A methodological guide.

5.5 The development of integrated environmental accounts

In order to develop satellite accounts for sustainable development it is necessary to identify the data gaps and needs, and structures that are needed to make further progress in this area along with the resource implications of such a programme of work. The development of the different types of accounts will be an ongoing process and those describing physical flows of materials and energy are the furthest developed at present and so they are the focus of the gap analysis. Data is available for other types of accounts such as environmental asset accounts which measure the stock and change of environmental assets, broadly represented by land use and land cover accounts and their further development is being led at a European level by the European Environment Agency. There is a lack of data on environmental expenditure accounts for Ireland in the EuroStat database but the standard tables clearly set out what data are needed and these do not directly relate to the indicators being assessed for inclusion under the spatial planning, management of natural resources, transport and public health themes and so they are not addressed in detail here.

5.5.1 Data gaps and needs

The data gaps identified in '*Counting what Counts*' which are relevant to the development of integrated economic and environmental accounts mainly relate to the theme 'production and consumption patterns'. Production and Consumption patterns have as their underlying statistical frameworks waste statistics and Material Flow Accounts.

Waste: The key gap in waste data is the unavailability of waste statistics by economic sector (NACE category). It is recommended that CSO should provide support to the EPA in the area of waste statistics, with a particular priority being the generation of statistics on waste production and management by economic sector (NACE category) and that the ongoing improvements and development of waste statistics be used as the basis for the development of a satellite account (NAMEA) for wastes.

Material Flow Analysis: The completion of the economy-wide Material Flow Analysis as part of the Island Limits project has put in place the building blocks for the development of satellite material flow accounts. It is recommended that the CSO extend the work of Island Limits to develop annual satellite Material Flow Accounts. The integration of ProdCom sales with trade statistics would be of great benefit in supporting this.

Air Emissions: The completion of the environmental satellite account for air emissions by the CSO represents a major development in environmental accounting in Ireland. However, as highlighted in the CSO report, the method employed for the estimates is limited by available data. It is recommended that further development of the air emission satellite account be undertaken to both improve data quality and to extend the range of gases include in the accounts, with a particular priority being given to extending the range of greenhouse gases included. It is recommended that the CSO build on the work of the Environmental Accounts 1997-2005 to produce extended environmental satellite accounts for emissions to air.

5.5.2 Resources and structures and capability development

'*Counting What Counts'* made 4 recommendations with respect to structures and capability:

- It is important that the development of an indicator set is resourced properly and the appropriate structures put in place to support this. The Central Statistics Office, ESRI and NESC should be resourced to carry out the development of SDIs, including development of regional indicators (where appropriate).
- The High Level Interdepartmental steering group on the NSDS should quickly identify and resource one agency or Department to take on a co-ordination role between data providers.
- National environmental accounting should be given a high priority and the appropriate organisation resourced sufficiently to enable further development of integrated economic and environmental accounting and the institutionalisation of material-flow accounting.

- The recommendations of the SPAR (Statistical Potential of Administrative Data) project should be reviewed in the context of development of SDIs and lessons learnt in the review be applied to the appropriate systems and structures established at the outset of the process of SDI development.

It is recommended that the Central Statistics Office should take on the role of co-ordination between data providers. This process could be started with a data exchange conference between all the organisations mentioned in this report who could contribute to the development of SDI for Ireland. The CSO already contributes at a European[28] and UN[29] level to the development of environmental accounts and SD data, statistics and indicators and it is recommended that CSO build on this process by developing further links with European partners with experience in the development of satellite accounts, in particular through networks with a particular knowledge base in production and consumption patterns such as ConAccount[30] and SCORE![31] (Sustainable Consumption and Production Research Exchange).

6. Recommendations for a full data set of sustainable development indicators using an indicator pyramid, which enables the prioritisation of the use of the indicators according to their use.

6.1 Introduction

The 1997 NSDS recognised that work towards a SDI set for Ireland would be refined as data collection systems, methodologies and consensus grows internationally about the choice of themes for international comparisons. '*Counting What Counts*' outlined some key questions for consideration when deciding on an SDI set, these include whether the composition of the set is driven by policy or available statistics; the size of the indicator set; and the selection criteria used.

The group of indicators assessed for inclusion in the SDI set has been complied on a statistics driven basis rather than a policy driven one, with only those indicators for which data is available included with the exception of vehicle-km for all modes. However the Level 3 indicators in particular will need to be linked to specific policies and as such the recommended set is a basis for discussion and will need to be revised in light of policy initiatives and recommendations in the NSDS. The Level 1 indicators are aimed at both high-level policy making and the general public and can be considered as a set of headline indicators. Denmark, Sweden, Germany and the UK have all produced 'headline' datasets of 15-20 SDIs which are usually widely disseminated. The number of headline indicators has been restricted to 20 so they can be used for effective communication and widespread dissemination.

6.2 Indicator assessment

The selection criteria used to assess the indicators was the EU RACER framework (see Table 1 for definitions). The assessment consisted of a two stage process; Stage 1 involved a scoring against the RACER criteria for all indicators not already part of the EU SDI. The assessment was not undertaken for those indicators already included in the EU SDI set as they have already been assessed by EuroStat and are considered to meet the criteria for inclusion as valid and robust indicators. Once the indicators were assessed they were then classified as Level 1, 2 or 3 indicators. In Stage 2 the range of Level 1, 2 and 3 indicators were tabulated under the eight challenges identified by Comhar with the addition of economic development. This enabled the number of indicators relating to each theme to be counted, any gaps identified and identification of indicators that can address more than one theme.

[28] Working Group on SDIs
http://circa.europa.eu/Public/irc/dsis/susdevind/library?l=/meetings_documents/working_group_sdi&vm=detailed&sb=Title
[29] Joint UNECE/Eurostat/OECD Working Group on Statistics for Sustainable Development. See
http://unece.org/stats/groups/wgssd.e.htm
[30] http://www.conaccount.net/
[31] http://www.score-network.org/score/score_module/index.php?cat_name=cat_t_sco_home

Table 1: RACER indicator assessment criteria

Criteria	Definition
Relevant	Policy support, Identification of targets and gaps
	Identification of trends
	Forecasting and modelling
Acceptance	Stakeholder acceptance
Credible	Unambiguous
	Transparency of method
Easy	Data availability
	Technical feasibility
Robust	Defensible theory
	Sensitivity
	Data quality

Each indicator was scored against the criteria using the following scale:
0 - Does not address the requirement
1 - Addressed the requirement inadequately
2 - Addressed the requirement partly
3 - Addressed the requirement fully

Nineteen indicators were assessed for inclusion in the SDI set, these comprised of both integrated indices and indicators.

Table 2: Scoring of new indicators against RACER criteria

	Relevant	Accepted	Credible	Easy	Robust	Score
GNP per capita	**3**	**3**	**3**	**3**	**3**	**15**
Harmonised index of consumer prices	**2** Does not fully support forecasting and modelling	**3**	**3**	**3**	**3**	**14**
GVA per region	**3**	**3**	**3**	**3**	**3**	**15**
Direct Material Input (DMI)	**2** Does not fully support forecasting and modelling	**3**	**3**	**3**	**3**	**14**
Domestic Processed Output (DPO)	**2** Does not fully support forecasting and modelling	**3**	**3**	**2** Requires use of waste statistics and dissipative output of products data	**2** Requires use of waste statistics and dissipative output of products data	**12**
Direct Material Output (DMO)	**2** Does not fully support forecasting and modelling	**3**	**3**	**2** Requires use of waste statistics and dissipative output of products data	**2** Requires use of waste statistics and dissipative output of products data	**12**
Physical Trade Balance (PTB)	**2** Does not fully	**3**	**3**	**3**	**3**	**14**

	support forecasting and modelling					
Resource Productivity	**2** Does not support forecasting and modelling	**3**	**3**	**3**	**3**	**14**
Resource Intensity	**2** Does not support forecasting and modelling	**3**	**3**	**3**	**3**	**14**
Environmental Sustainability Index	**2** Scorecard system. Does not address specific policy questions	**2**	**2** Uncertainty over definition of Environmental Sustainability (Weak vs Strong)	**2** Lack of data for some of the underlying indicators	**1** High number of indicators underlying the index resulting in lack of sensitivity to policy interventions	**9**
Inclusive Wealth Accounting (Genuine Savings)	**1** Measures current capital stocks and changes. Measures weak sustainability, may not reliable for policy support	**2** Measures weak sustainability, not accepted by all stakeholders	**2** Not unambiguous, different methods for calculation	**3**	**1-2** Assumptions on Natural Capital not completely defensible	**9-10**
Human Development Index (HDI)	**2** Does not fully support forecasting and modelling	**3**	**3**	**3**	**3**	**14**
Environmental Vulnerability Index	**1** No sustainability threshold for indicators. Does not fully support forecasting and modelling	**2** Qualitative judgement on scores	**2** Ambiguous policy signals. Large number of sub-indicators	**2** Technical feasibility of collecting data for all underlying indicators	**1** Subjective scoring, not sensitive to policy interventions	**8**
Ecological Footprint	**3**	**2** Not accepted by all stakeholders, currently under review by DGXI	**2** Concerns over transparency of method	**3**	**3**	**13**
Environmentally Weighted Material Consumption	**2** Can be used in policy support – links MFA and LCA. Cannot be used for forecasting and modelling unless linked to economic models	**2** Based on linking MFA and LCA – accepted but also criticised	**1** Lack of transparency and complexity of data	**2** Resources required for MFA and LCA	**2** Concerns over data quality	**9**
HANPP	**1** Cannot be used for forecasting and modelling unless linked to economic models	**2** Not accepted by policy community	**2** Message not clear, lack of thresholds	**3**	**2** Sensitivity to input parameters	**10**
River Water Quality	**2** Cannot be used for forecasting	**3**	**3**	**3**	**3**	**14**

	and modelling					
Per Capita Alcohol Consumption	**2** Cannot be used for forecasting and modelling	**3**	**3**	**3**	**3**	**14**
Index of Sustainable Economic Welfare	**2**	**2**	**2**	**2**	**2**	**10**

If the threshold for inclusion in a SDI set is greater than ten to ensure that each requirement is at least partially addressed then there are twelve indicators that can be considered for inclusion in the SDI set for Ireland. These are a combination of Level 1, 2 and 3 indicators and cover a range of themes (Table 3).

Table 3: Level and theme of new indicators

Indicator	Theme	Level
GNP per capita	Economic Development	1
Harmonised index of consumer prices	Economic Development	2
GVA per region	Economic Development	1
Direct Material Input (DMI)	Production and Consumption	2
Domestic Processed Output (DPO)	Production and Consumption	3
Direct Material Output (DMO)	Production and Consumption	3
Physical Trade Balance (PTB)	Production and Consumption	3
Resource Productivity	Production and Consumption	2
Resource Intensity	Production and Consumption	2
Human Development Index (HDI)	Economic Development/Public Health	1
Ecological Footprint	Production and Consumption/ Conservation and Management of Natural Resources	1
River Water Quality	Conservation and Management of Natural Resources	1
Per Capita Alcohol Consumption	Public Health	1

These indicators along with the available EU SDI indicators were complied into draft Level 1, 2 and 3 indicator sets for discussion. Where there were significant gaps such as spatial planning and management of natural resources, indicators from EPA and CSO publications have been included to supplement the EU SDI set. There are 20 headline indicators, which together can be used to communicate sustainable development in a holistic way (Table 4). The headline set includes several aggregated indices such as the Ecological Footprint and the Human Development Index as these address more than one theme. Although the HDI is not updated annually, its component indicators are and it is one of the headline indicators for Finland. Another headline indicator from Finland has been proposed for inclusion, per capita alcohol consumption, this is an indicator that has resonance with the public and is particularly relevant to the current public health debate.

Table 4: Draft Headline SDI set for Ireland

Climate Change and Clean Energy	Sustainable Transport	Sustainable Consumption and Production	Conservation and Management of Natural Resources	Public Health	Social Inclusion, Demography and Migration	Global Poverty and SDS	Spatial Planning	Economic Development
Total greenhouse gas emissions	Vehicle – km index	Domestic material consumption	Population trends of farmland birds	Current and projected old age dependency ratio	Level of citizens confidence in Govt institutions	Official development assistance	Built up areas	Growth Rate of GDP per Capita
Gross inland energy consumption by fuel	Total energy consumption of transport	Ecological Footprint	Fish catches from stocks outside safe biological limits	Healthy life yrs at birth by gender	Total-at-risk-of poverty rate after social transfers			GNP per capita
			River Water Quality	Human Development Index (HDI)				GVA per region
				Per Capita Alcohol Consumption				

There are 36 draft Level 2 indicators (Table 5) and 70 Level 3 indicators (Table 6). The number of indicators, particularly Level 3 will be reduced and amended to reflect the policies in the revised NSDS, however they are included here to form the basis for discussion on what should be included, excluded and which areas should be prioritised for development. Spatial planning clearly stands out as a theme for which more policy specific indicators should be developed and the number of economic development indicators could clearly be reduced.

Table 5: Draft Level 2 indicator set for Ireland

Climate Change and Clean Energy	Sustainable Transport	Sustainable Consumption and Production	Conservation and Management of Natural Resources	Public Health	Social Inclusion, Demography and Migration	Global Poverty and SDS	Spatial Planning	Economic Development
Energy intensity of the economy	Car share of inland passenger transport	Emissions of aggregated acidifying substances and	Groundwater abstraction	Percentage of overweight people	Total at-persistent-risk-of-poverty rate	imports from developing countries, total and agricultural products	Dwelling completions by region	Total investment by institutional sector
Final energy consumption by sector	Road share of inland freight transport	ozone precursors by sector	Designated areas	Resistance to antibiotics	Total long-term unemployment rate	Bilateral ODA by category		Labour productivity per hour worked
Gross electricity generation by fuel used in power stations	Emissions of air pollutants from	Municipal waste collected	Endangered, vulnerable and rare species	Salmonellosis incidence rate	Early school leavers: total	Imports of materials from developing countries by group of products		Real effective exchange rate
		Electricity consumption per dwelling			Relative mean income ratio			Total employment rate
		Share of area under agri-environmental support			Life expectancy at age 65 by gender			Harmonised index of consumer prices
		Livestock			General			

		density index			government debt			
		Direct Material Input (DMI)						
		Resource Productivity						
		Resource Intensity						

Table 6: Draft Level 3 indicators for Ireland

Climate Change and Clean Energy	**Sustainable Transport**	**Sustainable Consumption and Production**	**Conservation and Management of Natural Resources**	**Public Health**	**Social Inclusion, Demography and Migration**	**Global Poverty and SDS**	**Spatial Planning**	**Economic Development**
CO2 intensity of energy consumption	Modal split of passenger transport	Domestic Processed Output (DPO)	Size of fishing fleet	Healthy life years at age 65 by gender	At-risk-of-poverty rate after social transfers by gender, age group, highest level of education attained and by household type	Total imports from developing countries by income group		Real GDP growth rate
CO2 removed by sinks	Modal split of freight transport	Direct Material Output (DMO)	Population connected to waste water treatment services	Health care expenditure	Relative at-risk-of-poverty gap	ODA and FDI to developing countries by income group and geographical area		GDP per capita in PPS
Share of electricity from renewable energy to gross electricity generation by source	Volume of freight transport	Physical Trade Balance (PTB)	Forest trees damaged by defoliation	Cancer incidence rate by gender and type	Inequality of income distribution (Income quintile share ratio)	Share of untied ODA in total bilateral ODA committments		Regional breakdown of GDP per capita
Combined heat and power generation	Energy consumption by transport mode	Components of DMC		Suicide death rate by gender and age group	Gender pay gap in unadjusted form			Total consumption expenditure
Energy intensity of manufacturing industry	People killed in road accidents by road group	DMC by material		Percentage of present smokers by gender	Total very long-term unemployment rate			Net national income
Consumption of biofuels	Emissions of NOx from road vehicles	Municipal waste treatment by type of treatment method		Total serious accidents at work	People aged 0-59 living in jobless households, by age group			Inflation rate
Energy tax revenue		Household number and size		Proportion of population living in households considering that they suffer	At-risk-of-poverty rate after social transfers by most frequent activity			Total net saving by institutional sector

				from noise and from pollution				
		Meat consumption per capita			Persons with low educational attainment by age group			Unit labour cost growth, for total and industry
		Nitrogen surplus			At-risk-of-poverty rate after social transfers for persons aged 65 years and over			Life long learning :total
		Share of area occupied by organic farming			Total fertility rate			Turnover from innovation by economic sector
		Enterprises with an environmental management systems			Current and projected public pensions expenditure			Gross domestic R&D expenditure
		Eco-label awards by country and product group			Total employment rate by age group			Total public expenditure on education
					Average exit age from the labour market by gender			Total employment growth
					Current and projected public expenditure on care for the elderly			Total employment rate by gender & by highest
								level of educational attained
								Total unemployment rate by gender, age group
								& by highest level of educational attained
								Regional breakdown of employment rate

7. Conclusions and recommendations

7.1 Role of the SDI set

Ireland's revised NSDS will set out a range of challenges that need to be met to make progress towards sustainable development. To determine whether progress is being made, measurements are needed. These indicators must not only reflect changes in quality of life, but must also show if these changes are compatible with the planet's current ecological limits[32].
An indicator set will not measure all aspects of sustainable development but provides a simplified picture for use in policy and decision making. Each individual indicator will have strengths and weaknesses but it is their use in a basket of indicators that provides a more holistic picture of development. The SDI set has a key role in supporting the revised NSDS through:

- Identifying and prioritising policy measures
- Benchmarking Ireland's performance
- Supporting policy implementation
- Monitoring and evaluation
- Communication

7.2 Improvement of the SDI set

While there are clear gaps in Ireland's data collection systems and derived indicators which will be reflected in the SDI set, this is the first time that Ireland will have published a SDI set. The draft SDI set presented here for discussion is a starting point from which an initial SDI set can be derived and refined and improved over the course of the NSDS. This can be viewed as the start of a process of putting in place the frameworks and structures that will enable rapid progress to be made in measuring sustainable development. The outputs of the EPA STRIVE programme will be an important part of this process, which will also be driven externally by EuroStat and domestically by the CSO if the necessary resources are made available to do so.

7.3 Summary of recommendations

SDI set for Ireland

- An appropriate set of SDIs should be published with the revised NSDS to provide a basis of measuring progress on sustainability and a means to effectively communicate this to the general public.
- A hierarchical approach to SDIs should be used enabling the indicators to inform decision-making, benchmark and measure progress over time and measure the implementation of the strategy.
- The SDI set should incorporate relevant indicators that are already used by the European Union to minimise duplication of effort by statistical agencies in collecting and analysing data and further development of the indicator set should be adequately resourced.
- The headline indicator set in Table 4 should be considered for discussion as the Level 1 indicator set for Ireland.
- The SDI set should be reported on annually with the headline indicator set published in a format that enables widespread dissemination such as the UK 'Indicators in your pocket' booklet.

Data co-ordination

- It is recommended that the Central Statistics Office should take on the role of co-ordination between data providers. This process could be started with a data exchange conference between all the organisations mentioned in this report who could contribute to the further development of SDI for Ireland.

Satellite accounts

- It is recommended that CSO should provide support to the EPA in the area of waste statistics, with a particular priority being the generation of statistics on waste production

[32] Moran, D.D. *et al*., Measuring sustainable development - Nation by nation. Ecological Economics (2007), doi:10.1016/j.ecolecon.2007.08.017

and management by economic sector (NACE category) and that the ongoing improvements and development of waste statistics be used as the basis for the development of a satellite account for wastes (NAMEA) for wastes.

- It is recommended that the CSO extend the work of Island Limits to develop annual satellite Material Flow Accounts. The integration of ProdCom sales with trade statistics would be of great benefit in supporting this.
- It is recommended that further development of the air emission satellite account be undertaken to both improve data quality and to extend the range of gases include in the accounts, with a particular priority being given to extending the range of greenhouse gases included. It is recommended that the CSO build on the work of the Environmental Accounts 1997-2005 to produce extended environmental satellite accounts for emissions to air.

Improvement of the SDI set

- The SDI set recommended in this working paper should be re-examined in light of the revised EU SDI set which will be published at the end of 2007.
- Ireland's SDI set should be reviewed three years after the adoption of the set to incorporate the outputs of the STRIVE programme and as data availability improves.

Acknowledgements

We would like to acknowledge the input from Pat Fanning at the Central Statistics Office which was of great assistance in preparing this working paper.

Annex 1: Benchmarking Irelands Performance - graphs of headline indicators

Economic Development

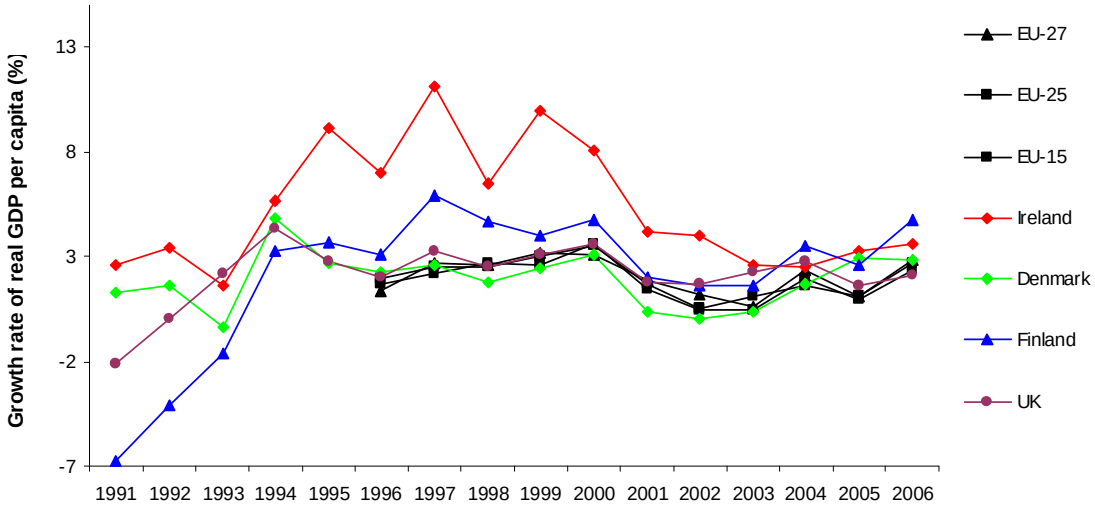

Figure A: Growth rate of GDP per capita (%)(EuroStat)

Climate Change and Clean Energy

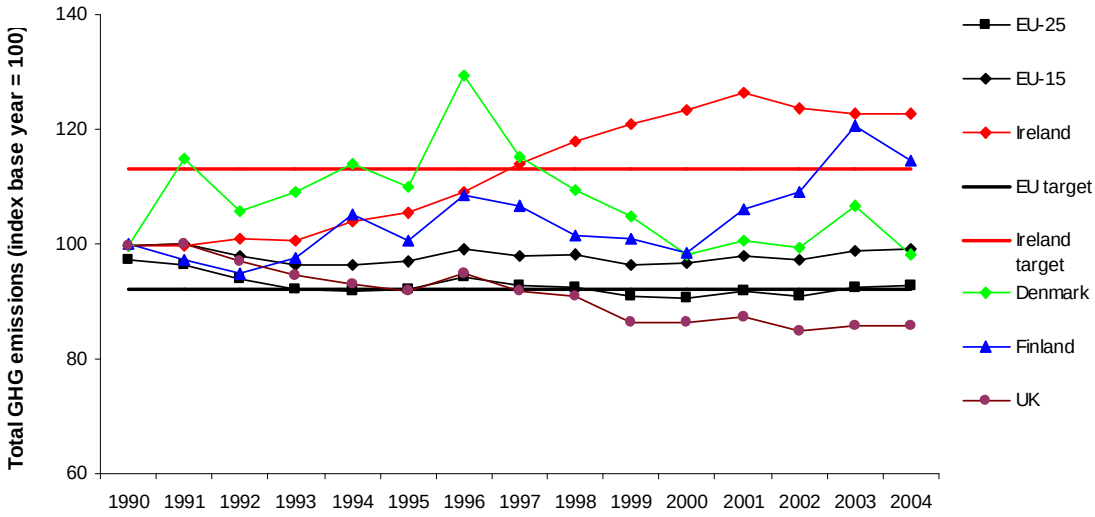

Figure B: Total Greenhouse Gas Emissions and Kyoto Target (EuroStat)

Sustainable Transport

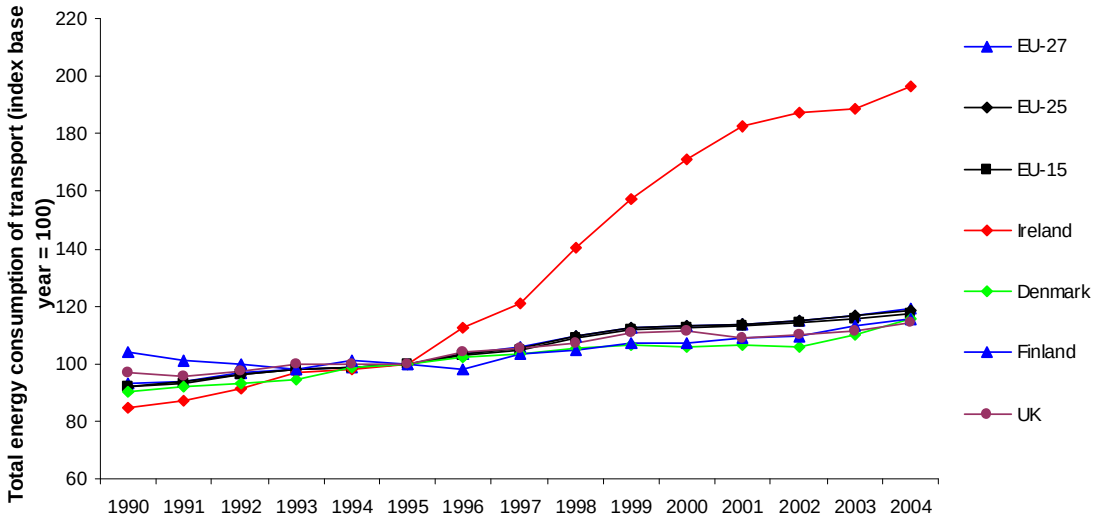

Figure C: Total Energy Consumption of Transport (EuroStat)

Sustainable Consumption and Production

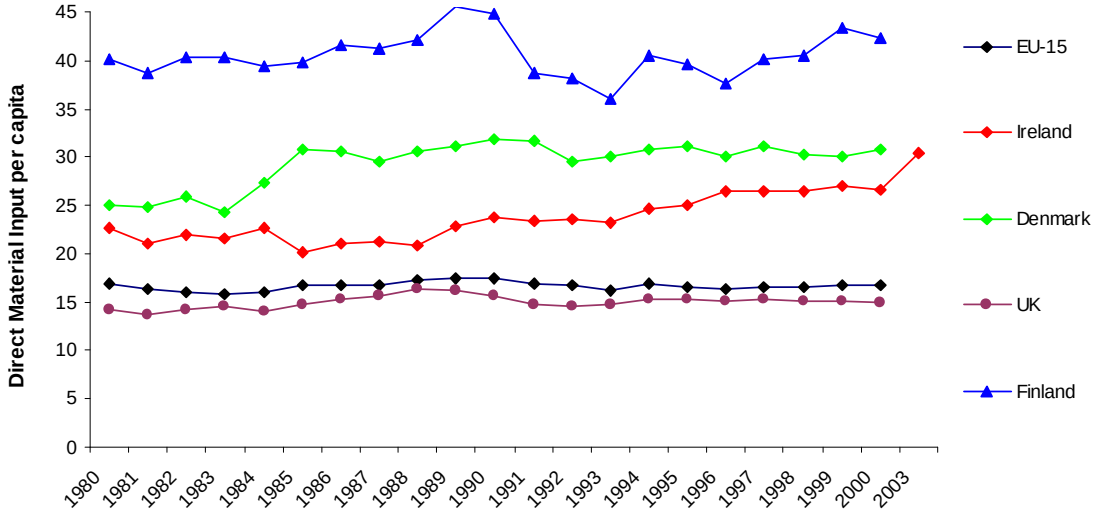

Figure D: Direct Material Input (Data from Island Limits and Wuppertal European Zero Study data set b)

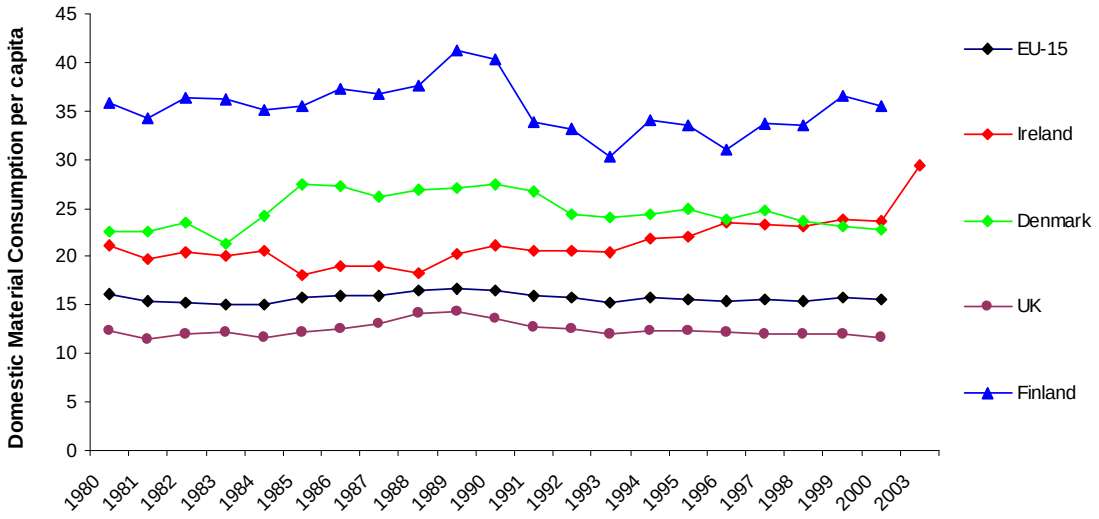

Figure E: Direct Material Consumption (Data from Island Limits and Wuppertal European Zero Study data set b)

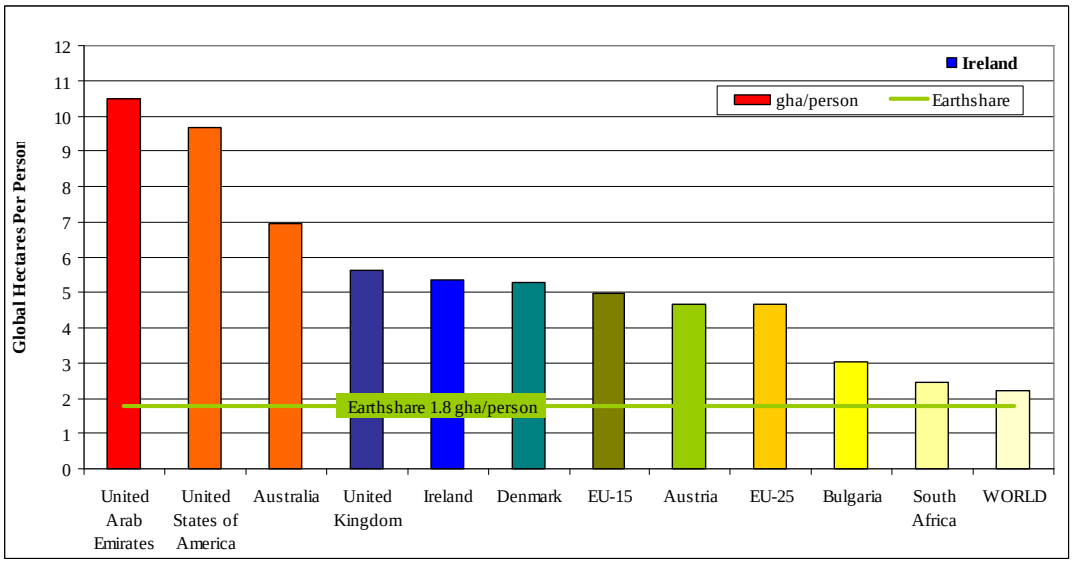

Figure F: Ecological Footprint of Ireland compared with other selected countries in 2003 (Data from Island Limits and Global Footprint Network)

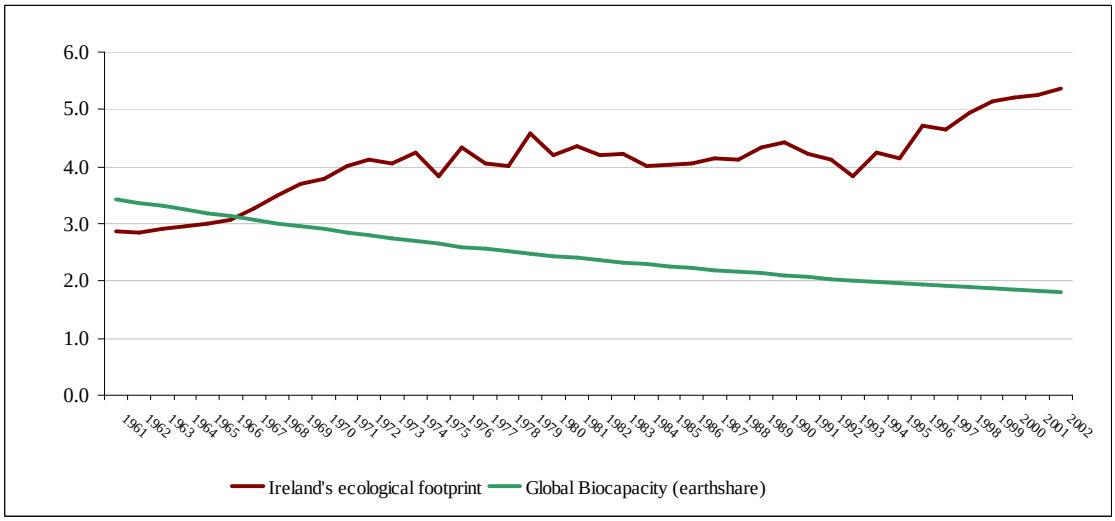

Figure G: Ireland's Ecological Footprint compared to global biocapacity per capita from 1961-2003 (Data from Island Limits and Global Footprint Network)

Conservation and Management of Natural Resources

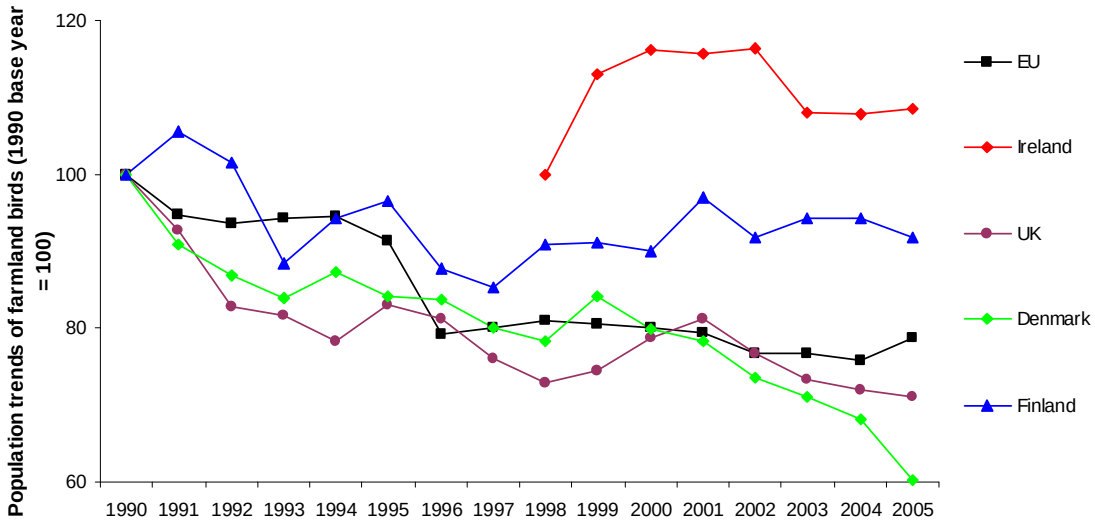

Figure H: Population trends of farmland birds (EuroStat)

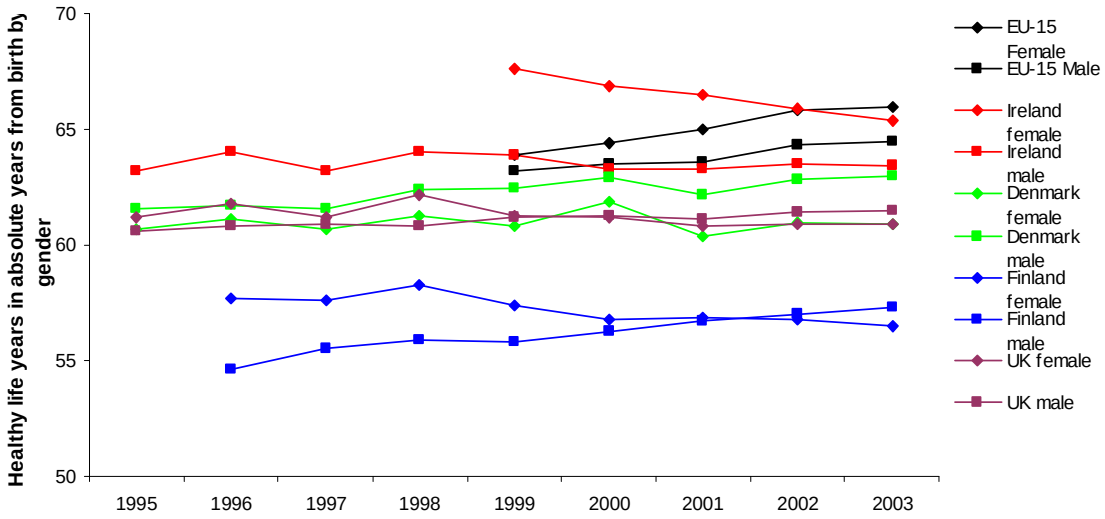

Figure I: Healthy life years in absolute years by gender (EuroStat)

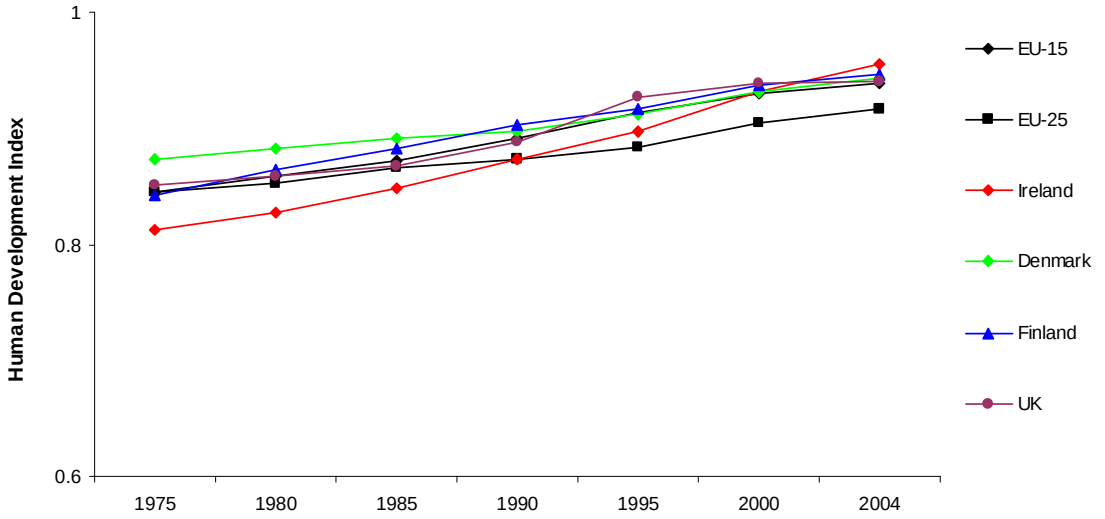

Figure J: Human Development Index (United Nations)

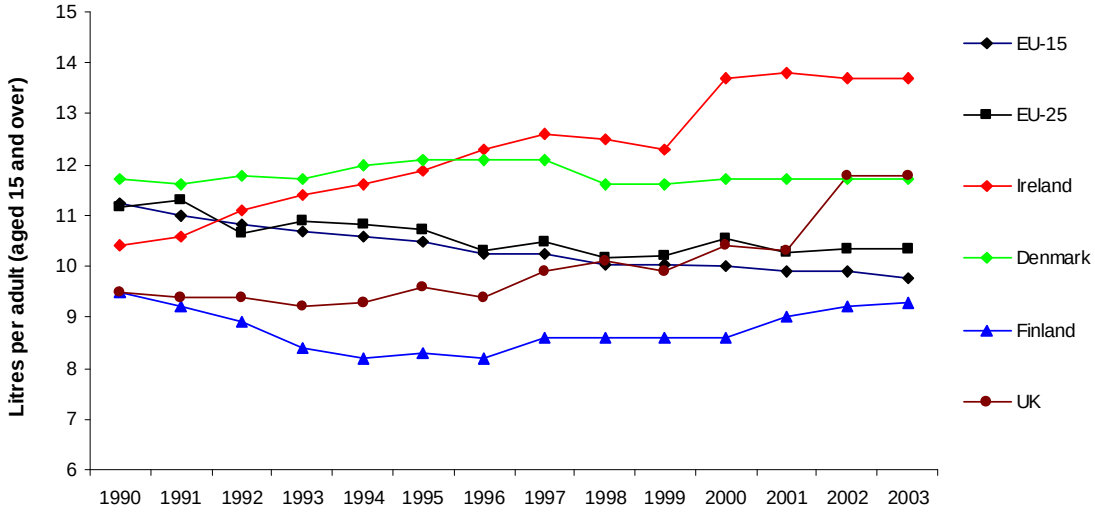

Figure K: Per capita alcohol consumption (World Heath Organisation)

Social inclusion, Demography and Migration

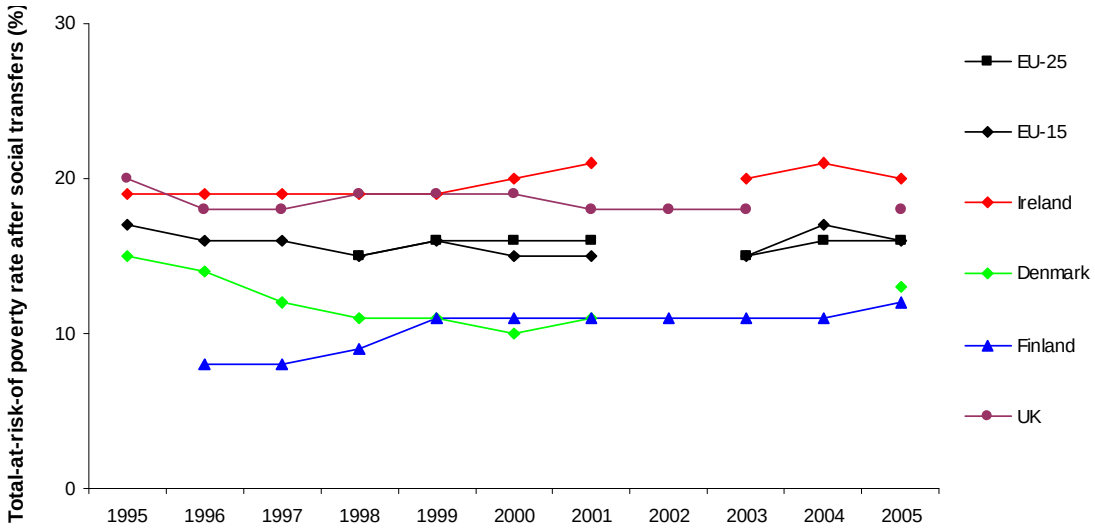

Figure L: Total at-risk-of-poverty rate after social transfers (EuroStat, data missing for some years)

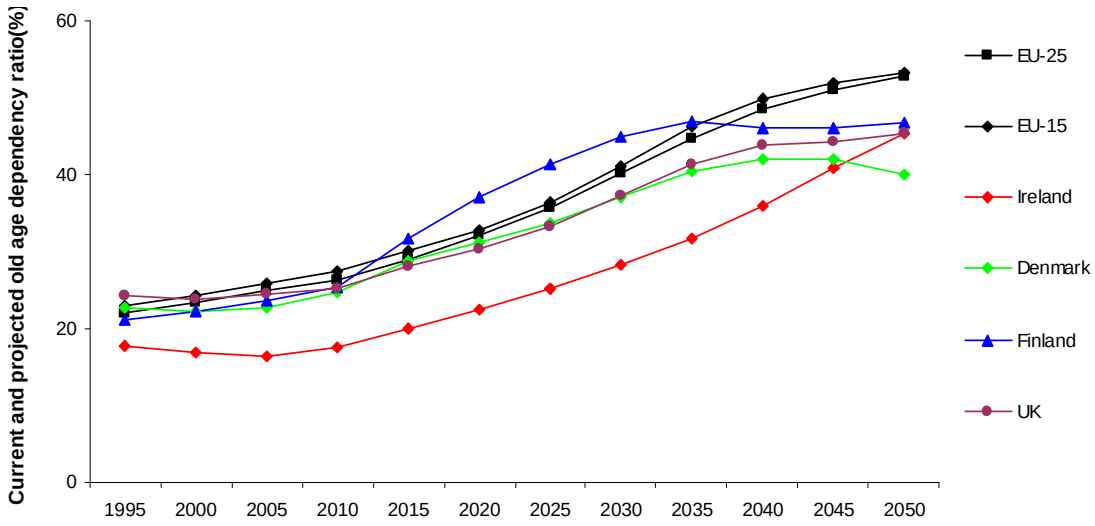

Figure M: Current and projected old age dependency ratio (EuroStat)

Global Poverty and SDS

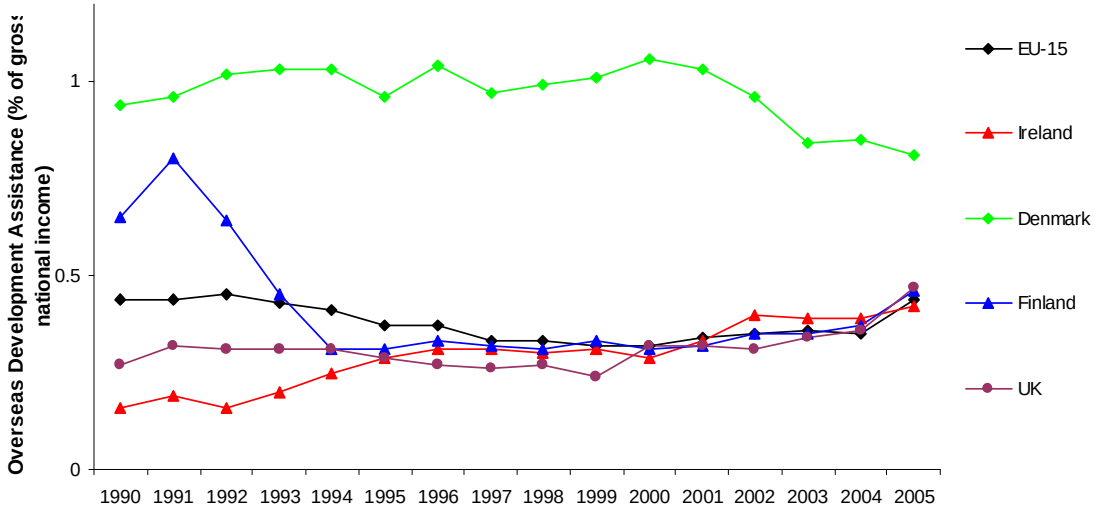

Figure N: Overseas Development Assistance (EuroStat)