Integration of Mainstream Economic Indicators
with Sustainable Development

D 7.2 Research Note:
Opportunities for a better use of indicators in policy-making: emerging needs and policy recommendations

Authors:

Samuela Bassi, Leonardo Mazza, Patrick ten Brink,
Keti Medarova, Sonja Gantioler, Jana Polakova,
Indrani Lutchman, Doreen Fedrigo-Fazio,
Peter Hjerp and Baroni, L. - IEEP
Elisa Portale – FEEM

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This report is submitted by: **Institute for European Environmental Policy (IEEP)**

London office:
15 Queen Anne's Gate
London SW1H 9BU - UK

Brussels Office:
Quai au Foin/Hooikaai 55
1000 Brussels - Belgium

Contacts for this report:

Samuela Bassi
Tel (direct): +44 (0)20 7340 2685
E-mail: sbassi@ieep.eu

Leonardo Mazza
Tel (direct): +32 (0)2 738 7477
E-mail: lmazza@ieep.eu

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Executive Summary

The importance of sustainability indicators and aims of the report

There is a growing concern that, at our current level of consumption and production patterns, we are engaged on a fundamentally unsustainable path. We are already consuming more than the planet can produce, with a global footprint equal to 1.5 planets (GFN, 2011) and, should current trends continue, it is expected that we will need the equivalent of more than two planets to sustain us by 2050 (EC, 2011a). Some non renewable resources will likely become highly scarce or exhausted, with demand potentially out-stripping supply (e.g. for certain minerals and fossil fuels) leading to major price volatility as well as lack of access to resources. Many renewable resources will be used beyond their natural generation capacity, leading to inefficient resource management (e.g. fisheries) and running down of the capital stock itself (e.g. fisheries, forest, soil). Furthermore, ecosystems can be pushed to a point beyond which they can no longer withstand external pressures (e.g. due to pollution, climate change, over-exploitation). In some cases this has already occurred (e.g. fisheries collapse in some areas, eutrophication of coastal areas leading to loss of marine life) and more risks occurring if consumption and production patterns, inefficiencies and impacts don't change. Whether such threshold points, which mark the boundaries of system integrity, are trespassed, there may be critical results, often irreversible (ten Brink et al., 2008).

There is therefore an increasing recognition of the need for policy to be driven not only by economic and financial motives, but also by sustainability concerns. For this reason, sustainability indicators are considered important tools to inform policy making.

Several initiatives aiming to stir policy making away from narrow economic motives have been already carried out in the past decade. The European Union, inter alia, stated its commitment to integrate economic indicators with sustainability principles at the '*Beyond GDP'* conference and its related Communication (COM(2009) 433), formalised a system of '*environmental accounts'* and recently unveiled its Strategy **'***Europe 2020: A strategy for smart, sustainable and inclusive growth'* (EC, 2010), which aims to turn the EU into a smart, sustainable and inclusive economy. At Eurostat's 2011 conference Environment Commissioner nik

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- nik, 2011).

Sustainability indicators are therefore emerging as crucial tools to inform policy making.

This part of the IN-STREAM analysis is dedicated to exploring the policy needs and opportunities of an increased use of sustainability indicators for selected policy areas, and providing guidance on how these could be adopted at different phases of the policy development process. The objectives are to:

- Assess to which extent different indicators (in particular the IN-STREAM indicators analysed throughout the project) are currently used in policy-making;

- Investigate the scope for further use of sustainability indicators across the policy-cycle of a number of selected policy areas, chosen in the light of current policy priorities;

- Understand how sustainability indicators have been taken up by the media so far, and highlight the potential for improving their communicability;

- Identify needs for additional indicators, barriers to further uptake and suggestions as to how the current gap in the use of indicators in policy making can be bridged; and

- Provide some useful policy recommendations to further stimulate the use of sustainability indicators in policy making.

Methodology used for the assessment

A policy cycle approach was adopted to identify the current and potential use of indicators within given policy areas. The analysis followed four key steps:

Step 1: Establish a list of **key environmental policy areas** which require a range of different indicators to assess progress towards sustainability. These are biodiversity, agriculture, fishery, resource efficiency, climate change and cohesion policy. To facilitate understanding, they were grouped into the three IN-STREAM storylines: green growth, resource efficiency and biodiversity. The full list of EU policies and legislation taken into account is shown in the table below.

Table 1 Storylines and associated policy areas selected for the analysis

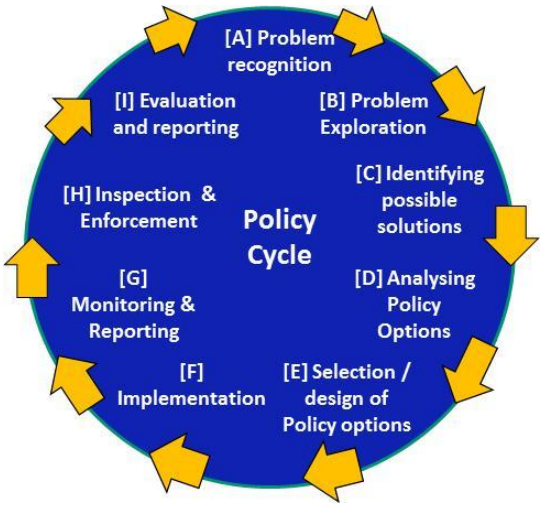
Storylines	Policy areas	Selected EU policies
Biodiversity	**Biodiversity**	• Habitats Directive • Birds Directive • Biodiversity Action Plan (BAP) • EU Biodiversity Strategy to 2020
	Agriculture	• Common Agricultural Policy (CAP), Pillar I • CAP Pillar II: European Agricultural Fund for Rural Development (EAFRD) and 2007-2013 Rural Development Programmes (RDP) • Others, e.g. 2007 Council Regulation on organic production and labelling of org. products
	Fisheries	• Common Fisheries Policy (CFP) • Integrated Maritime Policy • Marine Strategy framework Directive • Green Paper on the reform of the CFP
Green	**Cohesion**	• Community Strategic Guidelines on Cohesion 2007-2013

Storylines	Policy areas	Selected EU policies
growth	**Policy**	
	Climate Change	• EC Communication 20/20 by 2020; 20-20-20 climate and energy package • Energy Efficiency Directive • Renewable Energy Directive
	Energy efficiency	• Energy performance of buildings Directive • Energy Efficiency Action Plan • Energy Using Products (EUP) Directive
Resource Efficiency	**Resource efficiency**	• Thematic Strategy for the Sustainable Use of Natural Resources • Raw Materials Strategy • Resource Efficiency Roadmap 2050 • Sustainable Consumption and Production • Sustainable Industrial Policy Action Plan • Ecodesign Directive • Others: Water Framework Directive (WFD), CAP, CFP, Biodiversity policy, Energy policy, etc.

Step 2: Select **a range of indicators** to be taken into account in the analysis. These built on the range of indicators that underwent a thorough qualitative analysis under the project (see deliverable D2.2), namely: Gross domestic product (GDP), Adjusted Net Savings (ANS), System of Integrated Environmental and Economic Accounting (SEEA), Basket of resource indicators (EF, EMC, HANPP, LEP), Pan European Common Bird Monitoring Scheme (PECBMS), Favourable Conservation Status (FCS), Marine Trophic Index (MTI), Red List index, Potentially Disappeared Fraction (PDF), Per capita waste generation, Generation hazardous waste, Management radioactive waste, Energy Intensity of GDP, GHG emissions, Human Development Index (HDI), Happy Planet Index and National Accounts of Well-being. This was not meant to be an exhaustive list, but rather a restricted group of indicators which was instrumental for the IN-STREAM analysis. Other indicators have been taken into account when possible, on the basis of a desk based research and stakeholders' suggestions.

Step 3: Develop a framework to link different sustainability indicators to the various steps in the **policy-cycle** of the selected policy areas. For this purpose, tailored policy cycles were identified for each policy area under analysis. An example is shown in figure 1.

Figure 1 The policy cycle



Source: TEEB, 2010

Step 4: **Consultations** with policy-makers and experts on the selected policy-areas allowed to integrate a desk based research with different information on how indicators are currently used, how should be used in the future, and on key gaps

and opportunities. A questionnaire was developed to gather information (see the template in Appendix III).

The key messages from the analysis undertaken under each storyline are summarised below.

Biodiversity storyline: Key messages

Sustainability indicators for **Biodiversity policy:**

- Biodiversity is an umbrella concept whose measurement traditionally involves the simultaneous consideration of species diversity, genetic variability within populations, and the functional diversity of ecosystems. This level of complexity poses considerable challenges regarding the construction of policy-relevant biodiversity indicators. Biodiversity policy should thus be underpinned by a **basket of indicators** that capture the multifaceted nature of biodiversity, to avoid bias towards species, habitats and ecosystem services for which data is most readily available. Indicators should also be able to capture key trends and the risk of breaching critical environmental and resource thresholds.
- The process of developing and adopting EU-wide indicators in the field of biodiversity policy has mainly been driven by the reporting requirements of the **Nature Directives and to the Convention on Biological Diversity (CBD),** and the need to assess progress towards the headline target of halting biodiversity loss. Indicators have so far primarily addressed the environmental pillar of sustainable development, focusing on ecological **status and trends, and impacts** on ecosystems.
- There is a need, on one hand, to address current gaps through **further development of indicators** and, on the other, to **better integrate** the indicators developed by the scientific community into policy-making.
- The post-2010 biodiversity policy marks a **shift in emphasis towards ecosystem services** and the importance of biodiversity for human well-being. This calls for further refinement and development of ecosystem services indicators, in order to estimate trends in their provision and to provide a more complete picture of ecosystem resilience.
- According to the practitioners consulted, indicators in this field are in particular applied at four stages of the policy cycle: problem recognition, problem exploration, monitoring and reporting, and evaluation. There is scope for **further applying indicators in the intermediary stages** of the policy cycle, to identify possible solutions and support impact assessment or cost-benefit analyses of different policy options.
- While it is not always feasible to capture policy responses into a quantifiable indicator, the development of **standardised reporting/analysis** could support the application of qualitative indicators of response.
- Given the close linkages between biodiversity and other sectors, a streamlined set of biodiversity indicators that can be **integrated into several policy areas** should be developed. The use of frameworks like the **Natural capital accounts** (measuring stocks

of assets: forests, fish, land as well as soil, water, carbon in soils) and the **System of Economic and Environmental Accounts (SEEA)** have a lot of potential to integrate environmental considerations into policy decision.

Sustainability indicators for **Agriculture policy:**

- In **agriculture**, the importance of **public goods** merits **additional effort in developing biodiversity and ecosystem service indicators,** as well as indicators for social public goods, to ensure that the wider provision of public goods can duly be taken into account in policy decisions, funding, and investments, and in instrument design, implementation, monitoring and evaluation. The use of ecosystem services indicators will also be important to highlight and monitor the benefits provided by ecosystems to agriculture, such as aquifer recharge, flood control, water purification, pollination etc.
- In the context of the Common Agriculture Policy (CAP), **sustainability indicators are currently used for tracking impacts of the rural development policy** under Pillar 2, which focuses on rural development, as part of a programmed policy approach. They do not play a role under Pillar 1, which encompasses a non-programmed approach focusing primarily on income support, although there the bulk of CAP expenditure lies. This gap needs to be critically interrogated. In the end, both policy streams will have an impact on whether or not agriculture uses the resource base in a sustainable way.
- Additional sustainability indicators would be useful to understand the impacts of agricultural land use in Europe, and would help to identify which measurable sustainability objectives could be set for the CAP Pillar 1. These additional indicators might include, for example, Adjusted Net Savings, the System of Integrated Environmental and Economic Accounting (SEEA-2003), climate change indicators like GHG intensity, or GDP Energy intensity. In particular, it will be useful to explore the feasibility of **using resource indicators, such as the Human Appropriation of Net Primary Productivity (HANPP),** to develop aggregate information on the utilisation of the natural resource-base by agriculture.
- In theory, using indicators within the CAP Pillar 1 to measure environmental outcomes continues to be considered as a challenge. This is because of the **range of exogenous factors** that play an important role in agricultural management, such as the price of commodities and inputs, technological developments, market exigencies, trade issues, bioenergy policies and environmental regulation, as well as the effects of climate change on farming systems. In addition there are issues of additionality and data availability.
- Further efforts are needed to refine and extend the CAP Pillar 2 **Common Monitoring and Evaluation Framework (CMEF)** indicators. More efforts are also required to streamline and harmonise data collection the '**agri-environment'** indicators currently used in the EU-27 Farm Structure Survey and by Eurostat and to progress with the agri-environment indicators that are under development.
- In particular it is important that implementation of the **mandatory CMEF evaluations of biodiversity and High Nature Value (HNV) farming** improves, as the relevant indicators receive little attention in some Member States, whilst in others significant

progress has been made. The robustness of the methods for data aggregation for the HNV indicators needs some improvement too.

Sustainability indicators for **Fisheries policy:**

- The recognition of the over-exploitation of EU fish underlines the importance of having **good indicators to measures stock**, determine **sustainable yields**, set **targets** and **monitor** progress, as well as to measure the performance of the Common Fisheries Policy. Indicators can also be helpful to have a better understanding of the effect of fishing on the marine environment and on ecosystem services, and the impacts of pollution (especially eutrophication) on fisheries. This can be useful to inform not only fisheries policy, but also e.g. agricultural, waste water and municipal waste infrastructure issues and related policies (e.g. Liability Directive[1]).
- The European Commission's DG Mare currently uses a standard set of indicators in the fisheries management policy cycle and these have been developed through a number of research projects. Whilst there is a desire to use indicators at all stages of the policy cycle, the most developed indicators are the ecological indicators describing the state of the ecosystem. There has been progress on identifying social and economic indicators (e.g. used in impact assessment) but there is still a bias towards state and pressure indicators. Despite these developments, more research is needed to understand the **links between pressure and state indicators, pressure and response indicators and the links between the three** types of indicators.
- Indicators to measure 'good environmental status' of European seas are also under development under the Marine Strategy Framework Directive (MSFD). The development of **indicators for monitoring the performance of the CFP and the Marine Strategy Framework Directive (MSFD)** over time will also be needed.
- In order to enhance the use of sustainability indicators, the **Common Fishery Policy (CFP) objectives need to be clearly defined**, allowing for more flexibility at the regional scale to allow for development of **indicators relevant to regions**.
- A broader and more detailed set of data relating to fisheries should be requested to be reported under the **regulation on environmental economic accounts** in its next revision of the Data Collection Framework. In particular, data to support the assessment of cost of over-exploitation and the benefits from efficient management of the aquatic resources exploited by commercial fisheries should be collected.

[1] Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=2004&nu_doc=35

- If methodological improvements of the **adjusted Net Savings (Genuine Savings)** indicator are to be attempted, consideration for it to take depletion of fish stocks into account should be given.
- The **exchange of information between policy areas e.g. biodiversity and fisheries** should be facilitated in order to make the best use of information beneficial to both.

Resource Efficiency storyline: Key messages

- It is of foremost importance to **reduce the environmental impacts related to resource consumption**. To do so, resource efficiency indicators and targets should be set.

- It is not yet possible to create robust indicators on the impacts of resource use. The current focus should therefore be on **absolute amounts of resource used** for which statistics exist and are collected by national governments. In addition resource intensity indicators (resource use per unit output) will be valuable.

- Attention will be needed to **develop data sets on stocks of materials**, as flows on their own do not address over-consumption of either renewable or finite resources. A focus on stocks particularly links to the **identification of sustainability thresholds**, whether for renewable or non-renewable resources.

- The further development of a range of **sustainability indicators for resource use**, should be made a priority. Useful examples are the Environmentally Weighted Material Consumption (EMC), the Total Material Requirement (TMR) and the Total Material Consumption (TMC), Raw Material Consumption (RMC).

- Within the 'Footprint family' of indicators (see Gallo et al., 2011) the **Water Footprint and the Carbon Footprint** may be considered potentially more informative for resource efficiency policy than the Ecological Footprint: whereas the Ecological Footprint aggregates different categories in one indicator and is applied at the country level, Water and Carbon Footprints have the advantage of focusing on only one environmental category and can be applied at the country, sector, company, household and product level.

- It will be useful to asses the 'footprint' of wider product use – e.g. wood, soy, biofuels, palm oil, coffee, cocoa – especially in a global context and develop associated indicators to inform decision making and take third country impacts into account.

- The potential relevance of the **Index of Environmental Pressures and the World Bank's Adjusted Net Savings (ANS, also known as Genuine Savings)** for energy efficiency policy could be further investigated. ANS can be relevant in the resource efficiency discussion as far as it includes a component recording trends in stocks of certain natural assets and provides the opportunity to investigate the links between

different capital stocks and monitor resource efficiency relevant information. One can expect that the index will be sensitive to improvements in resource efficiency as these should reflect in changes in a whole range of the component indicators (variables) on which the index rests.

- Within the resource efficiency policy cycle, the '**problem recognition' and 'problem exploration' stages have been the focal area of indicator development to date**. The development of indicators for the stages of 'policy option design and implementation' has so far proven more limited.

- An appropriate **use of indicators in sectoral policies** will be crucial for target setting and monitoring of resource use by e.g. specific sectors of the economy and/or products.

- Focus will be needed in particular on those sectors with the largest environmental impacts and where significant amounts of resources are used. In this regard, three consumption areas are responsible for 75-80 per cent of our environmental impacts: **housing, food and drink, and mobility**. These sectors are clear priorities for achieving greater resource efficiency.

- Resource scarcity is a global issue. Therefore, it is not enough to consider domestic activities only. EU policies and indicators should **take into account environmental impacts occurring abroad** that are driven by national or European demand for imported goods

Green growth storyline: Key messages

Sustainability indicators for **Climate Change Policy**:

- In order to monitor the achievement of the targets set in the '20-20-20 climate and energy package' (COM(2008)16, 17 and 19), climate change relevant indicators have a crucial role to play. Specifically, **GHG emissions**, **energy intensity** and the **share of renewable energy consumption in total final energy consumption** are being closely monitored at European level. **Energy efficiency in buildings** is also an important indicator (both the specific efficiency value kWh/m^2 and the energy label with aggregate ratings), given the high potential of the building sector to deliver cost effective GHG mitigation.

- Opportunities for further **increasing accuracy and common methodology** in the measurement of energy intensity and of the share of energy from renewables exist and would be beneficial to better assess policy effectiveness.

- Consumption of renewable energy is not always easily measurable. A more systematic **breakdown by renewable energy source** (RES) would allow a better assessment of

the overall sustainability of the energy mix – it will be useful to look at both RES contribution to energy production and consumption.

- Due to frequent **export and import of renewable energy**, there might be significant differences between production of renewable energy and the actual consumption by a country, so in some cases an adjustment to account for these flows might be necessary.

- Adopting a more detailed sectoral approach for the GHG emissions and energy intensity indicators would be beneficial for a more thorough assessment of climate change policies, their divers and possible opportunities for improvements.

- Climate change indicators are often linked to **trends of other indicators** (socio-economic, environmental, energy related indicators). This calls for a more explicit identification of these linkage and consideration of cross-policy impacts at the most relevant stages in the policy cycle. This appears particularly crucial during the analysis of different policy options, where the use of multiple indicators can allow for the identification of relevant trade-offs and appropriate mitigating measures.

Sustainability indicators for **Cohesion Policy**:

- The focus of Cohesion Policy on economic development, and particularly growth and jobs, has arguably led to granting **more importance to the use of economic and employment indicators, at the expense of other sustainability indicators**, especially in the environmental domain.

- **GDP per capita is the only indicator used to determine the eligibility** of the different regions/Member States for EU Structural and Cohesion Funds and is mostly used to measure the achievement of the Policy's objectives. Its appropriateness to reflect new emerging challenges (e.g. climate change, energy security, etc.) and their impacts on regional economies, however, has increasingly been questioned.

- The **Community Strategic Guidelines on Cohesion call for the use of appropriate indicators on the state of the environment**. However, the proposed 'core' indicators are only of an indicative nature and Member States/regions are not legally bound to deploy them in the context of their programmes. Also, simple '**output' indicators** (e.g. a number of projects, etc.) are favoured, which are not very meaningful. The development of **'impact' indicators** has been difficult, as these are often perceived as less tangible.

- A great majority of environmental indicators currently adopted by Member States are **used at project level and primarily in the context of environmental interventions** – more particularly for reporting on the project's activity and output. EU funds programmes in which environmental indicators play a steering role are rather limited.

- In order to provide a more multi-faceted picture of regional development dynamics and trends, indicators such as the **Human Development Index (HDI), At risk-of-poverty**

rate after social transfers, Adjusted Net Savings (or Genuine Savings) should be used alongside GDP.

- There might also be some scope for using the **composite Index for environmental pressures, the ecological footprint, ecosystem indicators** such as the moderation of extreme weather events and the total economic value of services provided by ecosystems, and using wider **natural capital accounts and/or economic and environmental accounts** and associated indicators.

- The **development of a coherent and robust system of sustainability indicators**, suited to account both for outcomes and results, is critical in the context of Cohesion Policy. These should be embedded at the level of policy, programme and project. There is also need for investment in indicators, data and tools to help regions to commit to objectives of *carbon neutrality* and *no net loss of biodiversity*. Similarly, there would be valuable benefits to help assess the state of natural capital and flow of ecosystem services from ecosystems to social and economic systems. This will require data, spatial mapping and ideally also development of natural capital accounts for regions or other geographical levels (e.g. cities, river basins).

- This will require **additional administrative capacities and technical support systems** to guarantee the availability, collection, analysis and presentation of adequate data.

Key conclusions and recommendations

The policy analysis undertaken highlighted a number of important considerations and recommendations.

It is apparent that there are currently a fair number of **indicators that focus on state and pressures, while fewer are measuring impacts and responses**. As a result, indicators seems to be used especially in the early phases of the policy cycle, e.g. for problem recognition and decisions on policy options. There is scope to use indicators further, especially in the later stages of policy development.

The use of *'environmental accounts'* is important for integrating environmental considerations into policy decision. Frameworks like the **Natural capital accounts** (measuring stocks of assets: forests, fish, land as well as soil, water, carbon in soils) and the **System of Economic and Environmental Accounts (SEEA)** have a lot of potential and should be further supported by European, national and local institutions and statistical offices within the wider global context (SEEA is a United Nation led process, complementing the UN System of National Accounts - SNA)

The objectives of halting biodiversity loss, coupled with the new aim of halting ecosystem service losses, improve restoration of natural areas and the new interest in green

infrastructure, each require additional inputs in biodiversity indicators. In particular, the importance of **ecosystem service indicators** is increasingly recognised. These should be taken into account in several policy areas, not only biodiversity and nature related policies.

The issue of **ecological thresholds and tipping points** is of particular concern, as are issues of resource limits and planetary boundaries. Sustainability indicators have a key role to play, as they can inform about the proximity of such ecological and resource thresholds and the speed at which we are reaching them, and therefore help developing adequate policies to prevent breaching them.

The recognition of the **over-exploitation of EU fisheries** (with it being an 'underperforming natural asset') as well as of damage to the marine environment, underlines the importance of having good indicators to measures stock, assess the state of marine ecosystems, determine sustainable yields, set targets and monitor progress, as well as to measure the performance of the Common Fisheries Policy and the impact of the flow of services to communities.

In **agriculture policy**, the importance of **public goods** aspects (encouraging public goods such as carbon storage in soils, water retention, purification and flood control and avoiding public bads of pollution, impacts on water quality and availability, erosion) merits additional efforts at developing both biodiversity and ecosystem service indicators, to ensure that the wider public goods can duly be taken into account in decisions, funding, investments and instrument design, implementation, monitoring and evaluation.

It is of foremost importance to reduce the environmental impacts related to **resource consumption** (materials, water, energy, land and associated biodiversity). To do so, resource efficiency indicators and targets should be set. Introducing adequate indicators in sectoral policies will be crucial for target setting and monitoring of resource use by specific sectors of the economy and/or products, especially those with the largest environmental impacts (e.g. housing, food and drink, and mobility). It will be critical to assess the level of decoupling of resource impacts from economic growth and implications for future resource availability, prices, impacts and, ultimately, the sustainability of our socio-economic model and practices.

In order to monitor the achievement of the ambitious EU **climate change** targets, sustainability indicators have a crucial role to play, especially GHG emissions, energy intensity and the share of renewable energy consumption in total final energy consumption. This applies at global, national, local, business and citizen levels. Cross-policy impacts, especially with regard to biodiversity policy, should also be taken into account.

The development of a coherent and robust system of sustainability indicators, suited to account both for outcomes and results, is critical in the context of **Cohesion Policy (CP)**. Indicators should be embedded at the level of policy, programme and project. This will be important for understanding the impacts of the operational programmes (OPs) under CP, the

development path encouraged by investments, instruments and governance, for creating a valuable evidence base to support decisions by regional policy makers (e.g. informing investment in infrastructures, encouraging job creation all the while committing to environmental principles and objectives such as carbon neutrality or no net loss of biodiversity) as well as for appreciating the inter-linkages between economic, social and eco-systems. This will require additional administrative capacities and technical support systems to guarantee the availability, collection, analysis and presentation of adequate data.

In all the policy areas, there is clearly a gap between the importance of sustainability indicators that are most used or needed by policy makers and the information passed on to the general public by the media. While in general the **communicability** of sustainability indicators and the awareness around their importance should be improved, it may also be necessary to choose different indicators for analysis, policy setting, instrument design, performance checking, consumer information and wider public communication., including easily recognised indicators that motivate action (e.g. footprints, product labels and ratings including energy labels for products and buildings) There is also a need for timely, local and regular data to make the relevant issues 'live' for the public – which will require commitments for monitoring, reporting as well as 'now-casting'. This can ensure that the most robust indicators are used to inform policy choice, and at the same time that the importance of sustainability criteria is fully appreciated by the public.

The challenges facing policy makers in the next 5 to 10 years are different than those of a decade or two ago. At one level a lot of the legislation is in place and the changes needed are rather related to implementation, review and renewal (e.g. progress from 20/20/20 climate and energy target towards low a progressively more ambitious milestones and targets en route to a low carbon economy by 2050). The policy challenges are also increasingly complex. In the early days of legislation it was about single issue solutions such as emissions standards for effluent. Currently, policies are required on interconnected issues like climate change, biodiversity and resource efficiency, which also have major interconnection with actors and activities in other sectors. Furthermore, in this time of economic and financial crisis, there is an ever stronger need for a clear evidence-base to promote policy, design instruments and check performance. Finally with the growing economy and world population and associated growth in consumption and production, there is increase stress on the world's resources and ecosystems, with both resource limits and ecological thresholds either being breached or in danger of being so. This could induce changes that could be potentially dramatic, non-linear and irreversible. In light of these considerations, there is a critical role for sustainability indicators to play and also a fundamental need to move towards fuller integration of different environmental issues in national policies as well as economics and environmental accounts. Finally, there is a value in having an increasing informed public so that citizens can also participate in debates, make informed choices and be a core driver to the transition to a resource efficient, low carbon, economy that respects ecological values and resource limits and supports wellbeing and progress.

Table of Contents

Executive Summary 3

1 Introduction 19
1.1 The aim of the study 19
1.2 Structure of the report 20

2 Recent progress in the use of sustainability indicators for policy making 22
2.1 Beyond GDP and the composite index on environmental pressure 23
2.2 European environmental economic accounts 24
2.3 Europe 2020 25
2.4 Other international initiatives 27
2.4.1 The Stiglitz-Sen-Fitoussi Commission 27
2.4.2 OECD's recent initiatives on sustainability indicators 28
2.5 Examples of initiatives at country level – selected case studies 30
2.5.1 United Kingdom – Sustainability indicators and biodiversity 30
2.5.2 The Czech Republic – Sustainability indicators development in a co-operation with academia 31
2.5.3 Germany 32
2.5.4 Regional initiatives: RAMEA 34

3 Methodology: the policy cycle approach 36
3.1 Step 1: The policy focus within the IN-STREAM storylines 37
3.2 Step 2: Indicators selection 38
3.3 Step 3: The policy cycle 39
3.4 Step 4: Stakeholders consultation 42

4 Biodiversity and the value of Ecosystem Services 43
4.1 Biodiversity policy 48
4.1.1 Key policies where indicators have a role to play 48
4.1.2 Use of sustainability indicators at present 52
4.1.3 Successful examples of the use of indicators 66
4.1.4 Future opportunities 68
4.1.5 Policy recommendations 71
4.2 Agricultural policy 73
4.2.1 Key policies where indicators have a role to play 73
4.2.2 Use of sustainability indicators at present 77
4.2.3 Successful examples of the use of indicators 88
4.2.4 Future opportunities 89

4.2.5 Policy recommendations 91
4.3 Fishery policy 93
4.3.1 Key policies where indicators have a role to play 93
4.3.2 Use of sustainability indicators at present 95
4.3.3 Successful examples of the use of indicators 100
4.3.4 Future opportunities 101
4.3.5 Policy recommendations 102

5 Resource efficiency 104
5.1 Resource efficiency policy 108
5.1.1 Key policies where indicators have a role to play 108
5.1.2 Use of sustainability indicators at present 110
5.1.3 Future opportunities 118
5.1.4 Policy recommendations 123

6 Green growth 125
6.1 Climate change policy 132
6.1.1 Key policies where indicators have a role to play 132
6.1.2 Use of sustainability indicators at present 133
6.1.3 Successful examples of the use of indicators 138
6.1.4 Future opportunities 142
6.1.5 Policy recommendations 143
6.2 Cohesion policy 145
6.2.1 Key policies where indicators have a role to play 145
6.2.2 Use of sustainability indicators at present 147
6.2.3 Successful examples of the use of indicators 150
6.2.4 Future opportunities 151
6.2.5 Policy recommendations 158

7 Indicators for public communication and the press: empirical evidence and needs 161
7.1 Methodology and its limitations 162
7.2 Main results 164
7.2.1 Most popular key sustainability indicators 164
7.2.2 Conclusions and recommendations 168

8 Key findings and policy recommendations 170
References 174

Appendix I – Glossary 191
Appendix II – Indicators for fishery and cohesion policy 195
Appendix III Policy questionnaire for stakeholder consultation 203

List of Figures

Figure 3.1 The policy cycle – an example 40

Figure 3.2 A 10-stage policy cycle 41

Figure 4.1 DPSIR indicators and the policy life cycle 54

Figure 4.2 DPSIR and ecosystem services 56

Figure 4.3: SEBI indicators and areas of focus 57

Figure 4.4: Health and well-being – Possible Green Infrastructure indicators for underlying services/functions and resulting benefits 65

Figure 4.5: Indicators along the EU Biodiversity Policy cycle 69

Figure 4.6 Example of linkages between hierarchy of objectives and hierarchy of indicators, elaborates for the measure for Agri-Environment payments (214) 83

Figure 4.7 Example of use of indicators within the policy cycle of rural development 85

Figure 4.8 Fisheries Policy cycle post-2013: current and potential indicators 97

Figure 5.1 Current and future opportunities for using sustainability indicators in the resource efficiency policy cycle 117

Figure 6.1 Indicator use across the policy cycle of a policy supporting increased energy efficiency of building 138

Figure 6.2. Selected SD indicators along the EU Cohesion Policy cycle 155

Figure 6.3. Example of the relationship between Cohesion Policy stages, SIOOI-model and Procedural Instruments 158

Figure 7.1 Number of composite indexes measuring country performance 163

Figure 7.2 Worldwide trends in the Human Development Index 1970-2010 165

Figure 7.3 Highest number of mentions by indicator in selected media 166

Figure 7.4 HPI by sub-region 167

List of Tables

Table 1.1 Overview of storylines and associated policy areas selected for application of he above listed IN-STREAM indicators 20

Table 2.1 Europe 2020's headline targets and indicators 26

Table 3.1 Overview of storylines and associated policy areas selected for the analysis 37

Table 3.2 IN-STREAM Indicators used in this report 38
Table 4.1 Selected CMEF indicators with potential for the environment 80
Table 6.1 Climate change related indicators in key sustainable indicator lists 134
Table 7.1 List of Media Sources Used 162
Table 7.2 List of Indicators used 164

1 Introduction

I.I The aim of the study

This research note investigates the scope for strengthening the use of sustainability indicators in European Union (EU) policy, and provides guidance on how these could be used further. Overall, this study explores the current use and possible scope for further adoption of sustainability indicators throughout the development process of a number of selected environmental policy areas. The role of this research note within the overall stricture of the IN-STREAM project is summarised in Box 1.1 below.

The specific objectives of this study are to:

- Assess to which extent different **indicators** (in particular the IN-STREAM indicators analysed throughout the project) **are currently used in policy-making**;
- Investigate the **scope for further use of sustainability indicators across the policy-cycle** of a number of selected policy areas, chosen in the light of current policy priorities;
- Understand how **sustainability indicators have been taken up by the media** so far, and highlight the potential for improving their communicability;
- Identify **needs** for additional indicators, **barriers** to further uptake and **suggestions** as to how the current gap in the use of indicators in policy making can be bridged;
- Provide some useful **policy recommendations** to further stimulate the use of sustainability indicators in policy making

Box 1.1 This research note in the context of the IN-STREAM's project

This research note addresses IN-STREAM tasks 7.2 on the policy implication of sustainability indicators use, task 7.4 on case studies about how sustainability indicators have or can be used in some EU Member States, and task 7.6 on the needs for public communication and the press. The study is based on a desk based research and the involvement of stakeholders across a number of relevant policy areas.

This document presents the key findings of the research undertaken under these tasks. A summary of the key findings and recommendations elaborated in this research note and in deliverable 7.1 are provided in the final WP 7 deliverable D7.4 'Consolidated report'.

The analysis focuses on the so called 'IN-STREAM indicators', i.e. a set of indicators that have been used in the qualitative analysis of the IN-STREAM project (see chapter 3.2 for the full list of indicators). It should be noted that these are not meant to be an exhaustive list, as they are a selected group of indicators that were instrumental for the work. When possible and relevant, additional key indicators have been taken into account in this research note.

The works have been structured around three storylines - biodiversity, green growth and resource efficiency - and their related policy areas, which have been identified in the course of the IN-STREAM project - see also deliverable D7.1 for a full description. An overview is provided in the table below.

Table 1.1 Overview of storylines and associated policy areas selected for application of the above listed IN-STREAM indicators

STORYLINES	POLICY AREAS
Biodiversity	Core: Biodiversity. Fisheries, Agriculture policy Peripheral: Forestry
Green growth	Core: Cohesion Policy, Climate Change Policy Peripheral: Innovation. Policy Employment/Jobs, Competitiveness; Energy efficiency, Renewable Energy, Transport
Resource Efficiency	Core: Sustainable Resource Management (SRM) policies (e.g. Resource Thematic Strategy) Peripheral: Waste policies, Water policies

I.2 Structure of the report

This research note is structured as follow:

Chapter 2 presents the policy framework, providing an overview of recent policies calling for the use of sustainability indicators;

Chapter 3 introduces the concept of the policy cycle approach used for the analysis.

Chapter 4 presents the analysis on the current and potential future use of sustainability indicators in the context of key **biodiversity and ecosystem services policies.**

Chapter 5 focuses on the use of sustainability indicators for **resource efficiency** policies.

Chapter 6 deals with the use of sustainability indicators for **green growth** related policies.

Chapter 7 discusses the uptake of sustainability indicators by the **media** and the need for improving their communicability

Chapter 8 presents the key **conclusions and recommendations**

Chapters 4, 5 and 6 represent the core of the analysis and follow a common structure. Each chapter focuses on one the IN-STREAM storylines, and starts with identifying the key policies for which sustainability indicators have a role to play. They also outline how indicators has so far been used in each policy area, and to which extent they can further be used to strike a balance between the three pillars of Sustainable Development. This is followed by a more in-depth analysis on the current use of sustainability indicators and an overview of how these are currently influencing policy outcomes. A figure of the policy cycle illustrates on which phases of the policy process indicators are used. These insights into the current situation are further illustrated by some successful examples on the use of environmental/sustainability indicators in that policy area. This is followed by a mapping of future opportunities, including suggestions on where existing indicators could be better used, and on the role of new indicators. Whenever relevant, reference to the IN-STREAM indicators is made, although some additional policy-relevant indicators are taken into account when possible.

Based on this analysis, policy-specific recommendations are provided, in particular with regard to possible low-hanging fruits for a better use of sustainability indicators (e.g. better use of existing indicators at specific stages of the policy-cycle), the need for refining existing indicators to better inform policy-making, and the existence of persisting gaps calling for further development and use of indicators.

2 Recent progress in the use of sustainability indicators for policy making

> *'The welfare of a nation can scarcely be inferred from a measurement of national income'.* (Simon Kuznets, GDP's creator, 1934)

There is a growing concern that, at our current level of growth, we are walking through an unsustainable path. We are already consuming more than the planet can produce, with a global footprint equal to 1.5 planets (GFN, 2011), and the pressures on resources are further increasing. If current trends continue, by 2050 the global population is expected to have grown by 30 per cent to around 9 billion (EC, 2010a), with dramatic implications for consumption levels. If we carry on using resources at the current rate, by 2050 we will need the equivalent of more than two planets to sustain us (EC, 2011a).

It is expected that some non-renewable resources will become irreversibly lost, such as certain minerals and, most notably, fossil fuels. Furthermore, some ecosystems can be pushed to a point beyond which they can no longer withstand external pressures. Whether such threshold points, which mark the boundaries of system integrity, are trespassed, there may be critical results, often irreversible; for example, rivers can become unable to support life if oxygen levels fall below a certain point (ten Brink et al., 2008). See box below on the issue of environmental thresholds.

Box 2.1 The issue of environmental thresholds

The rapid expansion of human activities since the industrial revolution has now generated a global geophysical force equivalent to some of the great forces of nature. We are entering a new geological era in which our activities are threatening the Earth´s capacity to regulate itself.

A group of scientists have recently attempted to quantify the safe biophysical boundaries outside which our planet cannot function in the stable state in which human civilizations have so far thrived (Rockström et al., 2009) The research identified the Earth System's processes and potential biophysical thresholds, which, if crossed, could generate unacceptable environmental change for humanity. Nine boundaries were proposed: climate change, stratospheric ozone, land use change, freshwater use, biological diversity, ocean acidification, nitrogen and phosphorus inputs to the biosphere and oceans, aerosol loading and chemical pollution. For seven of them it was possible to quantify possible limits - e.g. for climate change the threshold could be CO_2 concentration in the atmosphere above 350 ppm.

These boundaries should be respected in order to reduce the risk of crossing these thresholds. These boundaries are strongly connected: crossing one boundary may seriously threaten the ability to stay within safe levels of the others. The study suggested that three of these boundaries (climate change, biological diversity and nitrogen input to the biosphere) may already have been transgressed.
Source: Rockström et al., 2009

In light of this, there is an increasing recognition of the need for policy to be driven not only by economic and financial motives, but also by sustainability concerns. For this reason, sustainability indicators are considered important tools to inform policy making.

At Eurostat's 2011 conference Environment Commissioner nik stressed that, now more than ever, resources devoted to environmental and social accounting should be at least equal to those going to classical national (economic and financial) accounting. '*We need to develop indicators to monitor progress on green growth, on green public procurement and on eco-innovation and develop a common understanding on how to measure harmful environmental subsidies'* noted the commissioner. Data on natural capital and its eco-system services needs also to be better measured, both in physical and monetary nik, 2011).

This section provides an overview of the recent progress in the use of environmental indicators in decision-making at EU and Member State level, namely: the Beyond GDP initiative and its composite index on environmental pressure, the European environmental economic accounts, Europe 2020 and other international initiatives by the Stiglitz-Sen-Fitoussi Commission and the OECD. The current and future role of sustainability indicators in specific EU policies is discussed in chapters 4-6.

This chapter complements deliverable D2.2 'Evaluation of Indicators for EU Policy Objectives' which introduces the following policies: Maastricht Criteria, The Lisbon Strategy, Sustainable Development Strategy, GDP and Beyond, Europe 2020.

2.1 Beyond GDP and the composite index on environmental pressure

In the 2007 international conference 'Beyond GDP' the Commission expressed its will to investigate possibilities to integrate economic indicators with sustainability principles. Following this commitment, in June 2009 the Commission published its communication '*GDP and beyond – Measuring progress in a changing world'* (CEC, 2009) pushing forward the idea 'to take stock of natural resources and human and social capital, rather than just the use of these resources,' as well as focusing on 'the role of eco-systems in providing welfare' (see deliverable D2.2. for further details on the Communication).

As foreseen in Communication, the Commission developed a **composite index on environmental pressures** for the European Union. The objective was to create an environmental index that reflects environmental pressure and that can be used in policy making alongside GDP and social indicators, as such to indicate whether progress is being made on environmental goals. The Composite Index is specifically meant to measure environmental pressure, 'reflecting the pollution and other harm to the environment caused physically within the territory of the EU to assess the results of environmental protection'.

Environmental protection has to be understood as actions preventing or reducing environmental pressures, for example a reduction of water pollution, reduced traffic noise, less soil sealing or lower greenhouse gas emissions. The index is, therefore, a pressure index and the percentage by which the index decreases against a previous year could be interpreted as the 'growth rate of environmental protection'.

The indicators selected for the composite index are sourced from various official sources and the more these indicators are taken up in national policy-making, the more reliable and robust they will become. While these indicators might therefore be those which can be expected to efforts in the upcoming years, they are primarily pressure indicators and a wider range of other useful indicators particularly fit for policy development and impact monitoring are used across Europe. A number of these may be particular valuable in their ability to in particular reflect the diversity of geographical conditions (i.e. biomes and ecosystems) across Europe.

2.2 European environmental economic accounts

For several years Eurostat, the EU statistical office, has collected and organised data into its so called '**environmental accounts'**. The accounts analyse the links between the environment and the economy at regional, national or European level. They builds on the United Nation's system of integrated environmental and economic accounting (SEEA) and aim to outline the potential impact of economic and social activity on the environment. To date, the accounts provide two types of measurements:

- The impact of current production and consumption patterns on natural resources[2], in relation to: Climate change, Decoupling of the use of resources, and Development of the environment industry.
- The effects of economic policy measures, such as Environment-related taxes, Subsidies, Current expenditure and Investment at industry level.

So far, data on environmental accounts has been reported by Member States to Eurostat on a voluntary basis. The recent **Regulation on European environmental economic accounts** (No 691/2011) by the European Commission formalised this process, and since August 2011 the submission of national environmental accounts to the European Commission has become a mandatory requirement. The environmental economic accounts are grouped in three modules: air emissions accounts, environmentally related taxes by economic activity, economy-wide material flow accounts. From 2012, Member States' will have to regularly report on these 'environmental economic accounts' to Eurostat. The data to be included under each one of these modules is set out in the regulation's Annexes.

[2] Eurostat: http://epp.eurostat.ec.europa.eu/portal/page/portal/environmental_accounts/introduction

It must be highlighted, however, that the regulation's scope is primarily to adjust current modules – it does not encompass the introduction of new ones. It does, however, foresee that the report on the implementation of this regulation, which the Commission is to submit by 31 December 2013, be accompanied, if appropriate, by proposal for the introduction of a range of additional account modules. These are outlined in the regulation and include:

- Environmental Protection Expenditure and Revenues (EPER)/Environmental Protection and Expenditure Accounts (EPEA)
- Environmental Goods and Services Sector (EGSS)
- Energy Accounts
- Environmentally Related Transfers (subsidies)
- Resource Use and Management Expenditure Accounts (RUMEA)
- Water Accounts (quantitative and qualitative)
- Waste Accounts
- Forest Accounts
- Ecosystem Services Accounts
- Economy-Wide Material Stock Accounts (EW-MSA)
- Measurement of unused excavated earthen materials (including soil)

The current three modules should help improve the evidence base for policy-making and informed wider public debates, and hence help governance through improved opportunities for 'measurement to manage'. The potential additional modules would take that further and help respond also to wider calls and commitments. For example the module on ecosystem service accounts would address the calls within the Economics of Ecosystems and Biodiversity initiative for natural capital accounts (TEEB, 2011) and also help the EU meet its commitment to having environmental accounts by 2020 as enshrined in the Convention for Biological Diversity Strategic Plan 2011-2020 (CBD, 2011)) .

2.3 Europe 2020

In March 2010, the European Commission unveiled its strategy entitled **Europe 2020: A strategy for smart, sustainable and inclusive growth** (EC, 2010), its much anticipated successor of the Lisbon Strategy. Given the current economic and financial context, a successful exit from the economic crisis was recognised as an immediate priority of the EU. In the longer term, the Europe 2020 Strategy aims to turn the EU into a smart (based on knowledge and innovation), sustainable (promoting resource efficient, greener and more competitive growth); and inclusive (high employment, delivering economic, social and territorial cohesion) economy. The Strategy proposes a series of headline targets relating to the three priorities. These EU targets are to be translated into national targets that reflect the situation in each Member State. The headline targets to be met by 2020 are:

- 75 per cent of the population aged between 20-64 to be employed;
- 3 per cent of the EU's GDP to be spent on R&D;

- 20-20-20 climate and energy targets to be met (including an increase to 30 per cent emission reduction 'if conditions are right');
- Share of early school leavers to be under 10 per cent and for at least 40 per cent of the younger generation to have a tertiary degree; and
- Reduce the number of Europeans living below the poverty line by 25 per cent

The Strategy's five headline targets are currently measured by eight headline indicators:

Table 2.1 Europe 2020's headline targets and indicators

HEADLINE TARGETS	INDICATORS
75 % of the population aged 20-64 should be employed	Employment rate by gender, age group 20-64
3% of the EU's GDP should be invested in R&D	Gross domestic expenditure on R&D (GERD)
Meeting the 20-20-20 climate/energy targets: Reduction of the greenhouse gas emissions by 20% compared to 1990; Increase in the share of renewable energy sources in final energy consumption to 20%; 20% increase in energy efficiency	Greenhouse gas emissions, base year 1990
	Share of renewables in gross final energy consumption
	Energy intensity of the economy (proxy indicator for *Energy savings*, which is under development)
The share of early school leavers should be under 10% and at least 40% of 30-34 years old should have completed a tertiary or equivalent education	Early leavers from education and training by gender
	Tertiary educational attainment by gender, age group 30-34
Reduction of poverty by aiming to lift at least 20 million people out of the risk of poverty or exclusion	Population at risk of poverty or exclusion *(union of the three sub-indicators below)*
	Persons living in households with very low work intensity
	Persons at risk of poverty after social transfers
	Severely materially deprived persons

Throughout 2010 EU countries is in the process of adapting the 5 EU-wide headline targets agreed for the whole EU to its national circumstances. These will be used to measure progress in meeting the Europe 2020 goals. The final national targets set are reflected in the Member State's national reform programmes.

The strategy includes seven flagship initiatives (see deliverable D2.2. for further detail), of which three may be considered particularly relevant with regard to moving towards the objective of environmental sustainability:

Resource efficient Europe: The aim under this initiative is to support the shift towards a resource efficient and low-carbon economy that is 'efficient in the way it uses all resources'.

At the EU level this includes: mobilizing EU financial instruments as part of a 'consistent funding strategy'; enhancing the use of market-based instruments; modernizing and decarbonizing the transport sector; promoting a 'substantial' program in resource efficiency which makes use of structural and other funds to leverage new financing; and establishing a 'vision of structural and technological changes' required to move to a low-carbon, resource efficient, and climate resilient economy by 2050 that will allow the EU to meet its emission reduction and biodiversity targets. At the national level this includes: phasing out environmentally harmful subsidies; using market-based instruments; developing transport and energy infrastructures; and addressing the urban dimension of transport.

Innovation Union: Proposals include developing a strategic approach to the EU's research agenda focused on *inter alia* energy security, transport, climate change, resource efficiency, environmentally-friendly production methods and land management; and developing the role of EU instruments (including structural funds and rural development funds) to support innovation;

Industrial policy for the globalization era: At the EU level, this includes the development of a framework for an industrial policy to *inter alia* support the transition to greater energy and resource efficiency and promote technology and production methods that reduce natural resource use and increase investment in existing natural assets.

In terms of governance mechanisms, the Commission proposes to adopt a 'small set' of integrated guidelines and to link reporting under the 2020 Strategy to the Stability and Growth Pact (which aims to ensure financial discipline among Member States) thereby increasing the political weight of country reporting under the Europe 2020 Strategy. This implies that Member States will propose annual stability and convergence programs and streamlined national reform programs in the autumn of each year. The Commission will then assess these country programs, evaluate progress towards meeting headline targets (on the basis of a set of indicators), present country-specific policy recommendations, and make policy proposals to achieve the objectives of the Strategy.

2.4 Other international initiatives

2.4.1 The Stiglitz-Sen-Fitoussi Commission

The Commission on the Measurement of Economic Performance and Social Progress (CMEPSP), also known as the Stiglitz-Sen-Fitoussi Commission, published its the landmark report in September 2009. The work of this Commission is motivated by the recognition of an 'increasing gap between the information contained in aggregate GDP data and what counts for common people's well-being', which requires to develop complementary measures able to address sustainability and people's concerns and well-being.

The Commission recognises that international effort must be directed to the identification of the limits of GDP as an indicator of economic performance and social progress, including the problems with its measurement. Moreover, the feasibility and relevance of additional, more relevant tools to complement GDP must be addressed, including how to present the statistical information in an appropriate way. In fact, addressing the shortcomings of GDP highlights another important aspect of policy making with regards to sustainability.

One of the main messages of the Stiglitz-Sen-Fitoussi Commission is that policy making requires not only to identify the correct concepts (what to measure), but also how to measure them (which statistical techniques) and report the results to the public.

The Commission's report stresses that time is ripe for our measurement system to shift emphasis from measuring economic production to measuring people's well-being. It argues that more attention needs to be paid to other existing aggregates such as National Income and Households Consumption needs.

The report first considers the properties of the existing National Income aggregate (derived from GDP), which aims to measure how much money we can dispose of freely for our own expenditures. Under the current system:

- where part of GDP is regularly sent abroad – e.g. to pay revenue to a foreign shareholder or to families of immigrant workers – GDP is adjusted for these revenue transfers with the rest of the world to produce the so-called 'Gross National Income';

- a second adjustment is made to account for the normal degradation of productive capital and the need to repair or replace it, to produce a 'Net' National Income.

The Commission examines which elements of this Income are not disposable (e.g. income tax for the Households sector) and which other imputations should be considered, e.g. non-market services supplied by the government sector. For instance, it proposes the compilation of a Net Disposable National Income, mostly targeted at improving households' well-being.

2.4.2 OECD's recent initiatives on sustainability indicators

At a ministerial meeting in Paris on 25 May 2011, the Organisation for Economic Cooperation and Development's (OECD) presented its Green Growth Strategy as well as three reports on green growth, the tools for achieving it and the indicators for reporting on progress (OECD, 2011a; 2011b; 2011c). These first deliverables under the Green Growth Strategy are part of the OECD's contributions to the Rio+20 process. They have the overall aim of supporting national and international efforts to achieve green growth, providing a 'practical framework for governments to boost economic growth and protect the environment'.

The OECD acknowledges that pursuing a Green Growth Agenda will require economies to rely increasingly on an extended set of indicators to allow measuring progress towards an effective implementation of the green growth 'toolkit'. The reports identify a set of policy areas that will be key in achieving more sustainable development. Energy, transport, agriculture and fisheries are amongst the sectors in which important shifts will have to be achieved on the way to a green economy.

The need for developing and implementing the framework conditions that promote green growth requires a good understanding of its determinants and of related trade-offs or synergies. It also requires appropriate information to support policy analysis and to measure progress. Progress can be measured through indicators that monitor trends and changes, and levels and that attract attention to issues that require further analysis. The OECD is therefore working on the development of indicators to capture major aspects of green growth in line with the Green Growth Strategy, and pay particular attention to efficiency and productivity issues, as well as to past and future developments. In addition, it recognises the importance of measuring whether green growth actually delivers reduced pressure on the environment and whether environmental quality is improving as a result. Interactions of environmental quality with people's well-being need also to be captured.

In particular, the report *Monitoring Progress: OECD Indicators* (OECD, 2011c) explores four inter-related groups of indicators, namely:

- Environmental and resource productivity (capturing the need for efficient use of natural capital and aspects of production which are rarely quantified in economic models and accounting frameworks);
- Economic and environmental assets (reflecting the fact that a declining asset base presents risks to growth, and because sustained growth requires the asset base to be kept intact);
- Environmental quality of life (capturing the direct impacts of the environment on people's lives, through for example access to water or the damaging effects of air pollution);
- Economic opportunities and policy responses (to help assess he effectiveness of policy in delivering green growth and where the effects are most marked).

The first has important parallels to the EU's Resource Efficiency Agenda. The second adopts the 'four-capitals' approach, including focus on natural capital, in line with the recommendations of the TEEB (2011). The third builds on the 'Beyond GDP' process, to which the OECD was also party, and the fourth reflects the traditional OECD focus. All aim to support a transition to a green economy that takes into account the wider wealth of nations and wellbeing of societies.

It is recognised that new or improved indicators and data will be needed to measure progress towards green growth, most notably in the areas of environmental quality, natural resource scarcity and quality-of-life beyond material wellbeing.

The OECD suggests distinguishing five groups of interrelated indicators:

(i) indicators reflecting the environmental efficiency of production as well as the absolute pressures associated with production,
(ii) indicators reflecting the environmental efficiency of consumption as well as the absolute environmental pressures associated with consumption
(iii) indicators describing the natural asset base of the economy,
(iv) indicators monitoring environmental quality of life, and
(v) indicators describing policy responses and instruments

2.5 Examples of initiatives at country level – selected case studies

Sustainability indicators are already playing a role at different levels of policy-making in the EU. At national level, most EU countries are collecting of data for sustainability indicators, while some have started to use them more substantially for national decision-making 9e.g. the UK, Germany and the Czech Republic). The potential for using sustainability indicators in policy making has been explored also at regional level, e.g. through regional cross-border projects such as the RAMEA/GROW project (see box below). The sharing of good practices across Member States and regions is crucial, as it can encourage broader use and implementation of sustainability indicators in policy-making. This section briefly discusses some case examples where such indicators have been used in the EU. Clearly more examples exist on more Member States and regions, and in some cases also at local level, therefore this should not be seen as a restrictive list or a selection of best cases, but rather a small set of illustrative examples to show that positive initiatives are been carried out across the EU. Furthermore, additional examples on the use of indicators are also mentioned in the policy-specific chapters of the report.

2.5.1 United Kingdom – Sustainability indicators and biodiversity

The United Kingdom has been carrying out several initiatives and research related to sustainability indicators, particularly in the area of biodiversity and nature accounting. For instance, a set of 18 ecosystem indicators comprising 34 measures (e.g. 'Breeding farmland birds', 'Breeding seabirds' and three other measures for the indicator 'Populations of selected species (birds)'), has been developed and reported annually since 2007[3]. Furthermore, a first National Ecosystem Assessment (UK NAE, 2011) was published in 2011. It is a first comprehensive evaluation of the current state and trends in UK's natural capital, which aims to facilitate better informed decisions, by particularly highlighting the links between human well-being and natural systems. The assessment employs ecosystem

[3] http://www.defra.gov.uk/statistics/files/UK-Biodiversity-Indicators-2011-statistical-release.pdf

services indicators for the evaluation of the state and value of the natural environment and of the effects of different policy scenarios on ecosystems (see also section 4.1.3).

In addition, the recent UK White Paper *The Natural Choice: securing the value of nature* (HM Government, 2011), published in June 2011, calls for a set of key indicators, to be developed in 2012, which would allow tracking the progress on the ambitions of the paper. A review of existing indicators and identification of gaps will be undertaken in order to provide an overview of progress and a report about the state of the UK environment will be published periodically. Furthermore, the White Paper emphasises that new metrics to measure the economic growth are needed and that the inclusion of natural capital into the UK Environmental Accounts is necessary to track the state of UK's nature.

The UK's Office for National Statistics (ONS) has also recently launched the initiative *Measuring national well-being*, which aims to provide new measures of national well-being covering economic growth, sustainability and environmental issues, but also subjective well-being measures. Initiated in November 2010, the initiative set off a five-month-national debate titled 'what matters to you', seeking to ensure that the views of stakeholders and of the wider public is included in the construction of the new well-being measurement framework. The debate was met with broad public participation – the ONS held around 175 events involving around 7250 people – and, overall, the debate has produced around 34000 responses (ONS, 2011). Amongst other issues, the debate highlighted that UK citizens are particularly concerned about most health, relationships, work and the environment, all of which should be reflected in a new measure of national well-being, together with education and training indicators (ONS, 2011).

2.5.2 The Czech Republic – Sustainability indicators development in a co-operation with academia

Monitoring the progress in the area of sustainable development in the Czech Republic has been closely connected to the work of academia since the early 1990's. A project on sustainable development indicators for the Scientific Committee on Problems of the Environment (SCOPE) was conducted by the Charles University Environmental Centre (CUEC) in the late 1990's. The resulting report, '*Indicators of Sustainable Development'* (Moldan and Billharz, 1997), provided a summary of key results and review of the latest development in the field of sustainability indicators. Furthermore, in 2001 the Czech Ministry of Environment commissioned the report '*The Czech Republic 2000: Environment and Quality of Life after Ten Years of Transition'* (Moldan and Hak, 2001), which looked at a wide set of sustainability indicators (e.g. emissions of major air pollutants, investments for environmental protection etc.) aimed to monitor the progress of the Czech society towards sustainable development. The report also informed the background document (Moldan and Kovanda, 2001) for the Czech Republic Sustainable Development Strategy. Furthermore, both the Strategy (Government of the Czech Republic, 2004) as well as the national Strategic Framework on Sustainable Development (Government of the Czech Republic,

2010) required regular reporting based on sustainability indicators (e.g. ecological footprint, populations of selected bird species etc.).

As of now, two main Czech periodic reporting on sustainability rely extensively on the use of sustainability indicators. The national report on Czech sustainable development strategy (currently on its third edition) uses 34 indicators, grouped into three pillars (Economic, environmental, societal) with additional three thematic areas ('Research and development, education'; 'European and international context'; 'Good governance'), as specified in the Czech Sustainable Development Strategy. Similarly, the annual Report on the State of the Environment in the Czech Republic is employing 39 sustainability indicators, including on biodiversity, climate and water quality.

In recent years, further attention is also being paid to assessing the linkages between quality of life and ecosystem services. This concept is being developed within an Agenda 21 project on Healthy Cities of the Czech Republic, originally initiated by the World Health Organization and recently promoted by the Czech Ministry of the Environment.

2.5.3 Germany

In 2002, the German Government adopted the National Strategy for Sustainable Development and agreed upon a sustainability indicator set comprising 21 indicators. Today, Germany has System of Core Environmental indicators[4] which mirrors the priority areas of the sixth Environmental Action Programme (6EAP) of the European Union (Climate Change, Nature and Biodiversity, Environment and Health, Natural resources and waste) and includes over 50 indicators, which were in part selected in view of the environmental policy priority areas for Germany.

In November 2010, Germany took a broader take to moving towards sustainable development with the establishment by the Bundestag of the 'Enquete-Commission Growth, Wealth, Quality of Life – Paths to sustainable economic management and societal progress in the social market economy'[5]. This Enquete-Commission has been tasked with determining the significance and weight of growth in the economy and society, to develop an all encompassing well-fare and progress indicator and to investigate the opportunities and barriers to the decoupling of growth, resource use and technical progress (Deutscher

[4] '*Das Umwelt-Kernindikatorensystem des Umweltbundesamts (KIS)*' URL: http://www.umweltbundesamt-daten-zur-umwelt.de/umweltdaten/public/theme.do?nodeIdent=2702

[5] '*Enquete-Kommission Wachstum, Wohlstand, Lebensqualität - Wege zu nachhaltigem Wirtschaften und gesellschaftlichem Fortschritt in der Sozialen Marktwirtschaft*'

Bundestag, 2010). The Enquete Commission has been requested to focus in particular on the five following aspects:

- *Significance/weight of growth in the economy and society*: the Enquete-Commission is expected, inter alia, to contribute to the public discussion on the importance of growth in the economy and society and its interrelationship with sustainable economic management; it will also investigate the question if and how the German economic and welfare state model can respond to the ecological, social, demographic and fiscal challenges in times of low economic growth.

- *Development of a holistic/integrated well-being and progress indicator:* the Commission will investigate how the factors having an influence on quality of life and societal progress can be adequately considered and can be brought together under one common indicator. Key aspects that will be taken into account include: material standard of living; access to and quality of labour; social distribution of wealth, social inclusion and cohesion; pristine environment and availability of limited natural resources; educational opportunities and educational levels, health and life expectancy; quality of public services, social security and political participation; and subjectively perceived quality of life and satisfaction. Based on these issues, the Enquete-Commission is expected to develop a new indicator which complements GDP, identify existing information gaps and prepare the building of the required statistical capabilities.

- *Growth, Resource consumption and technological progress – Opportunities for and limits to decoupling*: the Enquete-Commission will develop empirical data and scenarios on the availability and the consumption of resources and on the reduction of green house gas emissions, develop Strategies to avoid rebound effects, and identify key climate, biodiversity and natural resource ecological thresholds. Furthermore, it will investigate to which extent growth is fuelled by technological progress and identify future areas of technological progress which can contribute to resource efficiency.

- *Sustainable political and regulatory framework***:** the Enquete-Commission is meant to investigate which regulatory conditions need to be fulfilled for the objective of sustainable economic management in the framework of the market economy. In this regard, it will investigate, inter alias, how a more sustainable political and regulatory framework could further implement the polluter-pays-principle and contribute to resource efficiency.

- *Working environment, Consumption behaviour and lifestyles*: the Enquete-Commission should scan the work environment, consumption behaviour and lifestyles for opportunities for sustainable economic management and, where relevant, formulate recommendations for changes.

Based on its findings, the Enquete-Commission is requested to formulate concrete recommendations with regard to actions and measures to be taken. It shall identify a

pathway towards strengthening sustainable economic management within the market economy, show the ways to a sustainable wealth and societal progress and define the steps towards a sustainable economic management which reconciles economic, ecologic and social objectives.

In August 2011 the Enquete-Commission also initiated the first national survey on the meaning of currently common indicators such as GDP growth, unemployment rate and ecological footprint. The questionnaire was sent to Members of the European Parliament, of the Bundestag (national parliament), the regional parliaments and elected representatives at local levels as well as leading officials in Ministries. Results are expected at the end of 2011.

2.5.4 Regional initiatives: RAMEA

The RAMEA project was developed in the context of the 'GROW programme', a Regional Framework Operation within the INTERREG IIIC programme which aimed to support strategic co-operations in the areas of Green, Business and Inclusive growth between four regions in Europe - South East England (UK), Malopolska (PL), Emilia-Romagna (IT) and Noord-Brabant (NL). RAMEA is a regional version of the 'National Accounting Matrix including Environmental Accounts' (NAMEA), an environmental accounting system that combines economic and environmental accounts into a single framework.

RAMEA regional environmental accountings were developed to analyse the pressures on the environment by economic sectors and households through, inter alia, the use of sustainability indicators. RAMEA matrices were developed for the four 'GROW' regions, in order to explore the possibilities for cross-regional comparisons of economic-environmental performance (see Box 2.2 for the RAMEA for the region Emilia-Romagna). This was meant to provide policy-makers with a supportive tool for decision-making and increase the cross-border co-operation in the area of sustainability. Among its features, RAMEA can help construct eco-efficiency indicators and scenario analysis, when used in combination with the Input-Output analysis (Sansoni et al., 2010).

The RAMEA project helped to test environmental accounting in practice and has the potential to help to mainstream the use of accounting and indicators into other policies and regions. However, there are still numerous difficulties in achieving comparable regional models, particularly with regards to availability of affordable economic and environmental data (Sansoni et al., 2010).

Box 2.2 RAMEA in the Emilia-Romagna region

A simplified structure of the RAMEA matrix for the Emilia Romagna region – located in Northern Italy - is presented below. It was constructed using four economic aggregates and five environmental indicators and shows the percentage contribution of different economic sectors and households to the economy and the environment (data relate to the year 2000).

		RAM				EA				
Emilia-Romagna 2000		Economic aggregates				GHG	Acidif.	Local air quality		
NACE	Industries	Output	Value added	Final cons.	Labour input	CO_{2eq}	H^+_{eq}	NMVOC	CO	PM
A,B	Agriculture and Fishery	2.6	3.5		6.2	12.2	47.0	4.6	9.8	24.2
C	Mining/quarrying	0.1	0.2		0.1	0.1	0.1	0.2	0.0	0.2
D	Manufacturing activities	39.6	26.6		27.4	31.5	21.2	30.7	2.4	31.3
E	Electricity, gas, water supply	1.5	1.3		0.5	14.3	10.2	3.2	0.5	4.6
F	Construction	5.4	4.9		5.8	0.2	0.1	3.9	0.1	2.2
G,H	Wholesale, retail trade, hotels, restaurants	14.4	17.2		21.4	2.0	0.7	1.7	0.5	0.9
I	Transport, storage, communication	6.2	6.8		5.8	7.0	7.5	6.9	5.6	13.2
J–Q	Other services	30.1	39.5		32.8	6.2	1.9	1.3	2.1	2.1
COICOP	**Households**									
07	Transport			12.7		12.3	9.1	34.1	70.3	13.3
–	Other consumptions			87.3		14.2	2.1	13.3	8.7	8.0
Total – Industries		**100.0**	**100.0**		**100.0**	**73.5**	**88.8**	**52.6**	**21.0**	**78.7**
Total – Households				**100.0**		**26.5**	**11.2**	**47.4**	**79.0**	**21.3**
Total		**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Sansoni et al. (2010)

3 Methodology: the policy cycle approach

> *In our every deliberation, we must consider the impact of our decisions on the next seven generations* (The Great Law of Iroquois Confederacy)

Decisions need to be taken at different stages of policy making, and sustainability indicators can help inform different stages of this process. A policy cycle approach can help identify in which stages sustainability indicators can be particularly useful, and what type of support they can provide to each step of policy development.

Notably, The Economics of Ecosystems and Biodiversity (TEEB) report for policy makers (TEEB 2011) underlines that, in the context of a policy cycle, indicators can help develop and communicate an understanding of the relationship between drivers and effects. For instance, the TEEB report stresses that biodiversity and ecosystem service indicators (such as the footprint) can be useful at different stages of the policy cycle, such as: problem recognition (e.g. endangered habitats and loss of ecosystem services); identification of solutions (e.g. favourable conservation status and necessary management activities); assessing and identifying linkages between policy options (e.g. investment in protected areas, green infrastructure); the implementation process (e.g. reforming subsidies, payment for ecosystem services); and ongoing monitoring and evaluation (e.g. status and trends).

A policy cycle approach was therefore chosen in the IN-STREAM project to identify the current and potential use of indicators within a given policy area. The steps followed in the analysis were as follow:

Step 1: Establish a list of **key environmental policy areas** which require a range of different indicators to assess progress towards sustainability. In order to facilitate understanding, these policy areas were grouped into the three IN-STREAM storylines: green growth, resource efficiency and biodiversity.

Step 2: **Select a range of indicators** to be taken into account in the analysis. These built on the IN-STREAM indicators used in the course of the project, as well as other indicators identified through a desk study and with the help of stakeholders. This was not intended to be an exhaustive list, but an example of how certain indicators can be helpful in policy making

Step 3: Develop a framework to link different sustainability indicators to the various steps in the **policy-cycle** of the selected policy areas. For this purpose, tailored policy cycles were identified for each policy area under analysis

Step 4: **Consultations** with policy-makers and experts on the selected policy-areas allowed to integrate a desk based research with different information on how indicators are currently used, how should be used in the future, and on key gaps and opportunities

3.1 Step 1: The policy focus within the IN-STREAM storylines

Sustainability indicators have the potential for informing decision-making across a range of policy areas with significant implications for the environment, society and the economy.
The selection of policy areas was guided and structured around the three thematic storylines that have been adopted in the IN-STREAM analysis.

These storylines aims to reflect key topical issues in the EU policy domain, and concentrate on three areas:

1) green growth - with a focus on climate change mitigation and adaptation and cohesion policy),
2) halting biodiversity loss – focusing on biodiversity, agriculture and fishery policies
3) increasing resource efficiency – focusing on the Resource Efficiency Thematic Strategy

In the two former areas, ambitious targets have been adopted, while in the latter the introduction of targets is under consideration in the context of the Europe 2020 resource efficiency Flagship initiative and Roadmap. These three storylines have been used to determine the policies areas and the presentation of the project's findings in the present research note. The table below provides an overview of the storylines selected and the policies which have been associated with the different storylines.

Table 3.1 Overview of storylines and associated policy areas selected for the analysis

STORYLINES	POLICY AREAS	SELECTED EU POLICIES
Biodiversity	**Biodiversity**	• Habitats Directive • Birds Directive • Biodiversity Action Plan (BAP) • EU Biodiversity Strategy to 2020
	Agriculture	• Common Agricultural Policy (CAP), Pillar I • CAP Pillar II: European Agricultural Fund for Rural Development (EAFRD) and 2007-2013 Rural Development Programmes (RDP) • Others, e.g. 2007 Council Regulation on organic production and labelling of org. products
	Fisheries	• Common Fisheries Policy (CFP) • Integrated Maritime Policy • Marine Strategy framework Directive • Green Paper on the reform of the CFP
Green growth	**Cohesion Policy**	• Community Strategic Guidelines on Cohesion 2007-2013
	Climate Change	• EC Communication 20/20 by 2020; 20-20-20 climate and energy package

STORYLINES	POLICY AREAS	SELECTED EU POLICIES
		• Energy Efficiency Directive • Renewable Energy Directive
	Energy efficiency	• Energy performance of buildings Directive • Energy Efficiency Action Plan • Energy Using Products (EUP) Directive
Resource Efficiency	**Resource efficiency**	• Thematic Strategy for the Sustainable Use of Natural Resources • Raw Materials Strategy • Resource Efficiency Roadmap 2050 • Sustainable Consumption and Production • Sustainable Industrial Policy Action Plan • Ecodesign Directive • Others: Water Framework Directive (WFD), CAP, CFP, Biodiversity policy, Energy policy, etc.

3.2 Step 2: Indicators selection

This research note focuses on a selected number of sustainability indicators which have been used in the IN-STREAM analysis - referred thereafter as the 'IN-STREAM indicators'.

In particular, this analysis builds on 16 IN-STREAM indicators that underwent a thorough qualitative analysis under deliverable D2.2. ('Evaluation of Indicators for EU Policy Objectives'). These are listed in the table below.

It should be noted, however, that the IN-STREAM indicators do not mean to be an exhaustive list, but only a restricted group which was instrumental for the IN-STREAM analysis. In this research note other indicators have been taken into account when possible, although the focus remained on the IN-STREAM set.

Table 3.2 IN-STREAM Indicators used in this report

Keys:

EC = economic pillar *EN= environmental pillar* *SO = social pillar*
CLIM= climate change *RES = Resource Efficiency* *BIOD = Biodiversity*
AG = Agriculture *FISH = Fishery* *COH = Cohesion* *ALL = all policies*
BD = Biodiversity *GG = Green Growth* *RES = Resource Efficiency*

IN-STREAM INDICATORS	SD PILLAR	POLICY	STORYLINE
Gross domestic product (GDP)	EC	ALL	ALL
Adjusted Net Savings (ANS)	EC	ALL	ALL
System of Integrated Environmental and Economic Accounting (SEEA)	EC/EN	ALL	ALL

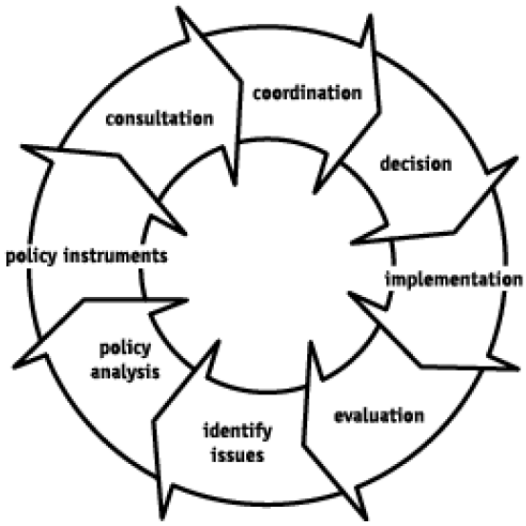
IN-STREAM INDICATORS	SD PILLAR	POLICY	STORYLINE
Basket of economic indicators (GDP, SEEA, ANS)	EC	ALL	ALL
Basket of resource indicators (EF, EMC, HANPP, LEP)	EC/EN	ALL	ALL
Pan European Common Bird Monitoring Scheme (PECBMS)	EN	BIOD/AGR	BD
Favourable Conservation Status (of habitats and species)(FCS)	EN	BIOD	BD
Marine Trophic Index (MTI)	EN	FISH	BD
Red List index	EN	BIOD/AGR	BD
Potentially Disappeared Fraction (PDF)	EN	BIOD/AGR	BD
Waste indicators (Per capita waste generation, Generation hazardous waste, Management radioactive waste)	EN	RES	RES
Energy Intensity of GDP	EN	CLIM	GG
GHG emissions	EN	CLIM/RES	GG/RES
Human Development Index (HDI)	SO	ALL	GG/RES
Happy Planet Index (HPI)	SO/EN	ALL	ALL
National Accounts of Well-being (NAW)	SO/EN	ALL	GG/RES

It is clear that other useful indicators are available, and that more indicators may be produced in the future. Furthermore, while these are quite general indicators, it is apparent that policy making can require ad hoc-indicators depending on the specific issue they intend to address, the geographic area in which they are to be implemented, their interaction with other policies and needs, etcetera. The aim of this research note therefore is not to provide a receipt for which indicators to use in policy making, but rather to show how selected indicators can contribute to the policy process, and highlight the scope for further use of sustainability indicators in the future.

3.3 Step 3: The policy cycle

There is no single, straight-forward definition of a standardised process for developing policy. However, policy development can be seen as an iterative process, and described by a 'policy cycle'. According to this view, the development of a policy moves through a cycle of stages, from issue identification (e.g. of a problem that needs to be addressed through policy) through to evaluation (e.g. of a policy's effectiveness). The cycle can be divided into different intermediate stages such as planning, implementation, monitoring, etc. There are different versions of the policy cycle depending on the emphasis needed and the complexity of the issue at hand. A textbook example by Bridgman and Davis (2004) is shown in Figure 3 below, where the policy process is depicted as a cycle consisting of 8 stages.

Figure 3.1 The policy cycle – an example



Source: Bridgman and Davis, 2004

It can be argued that a policy cycle is an artificial structure that may not fully reflect the complexity of policy development – for instance, policy stages may not be sequential, they can overlap, or consist of more or less intermediate steps. De Smedt (2008) notes that changes in policy and policy implementation are rarely the result of a linear process, but rather the result of iterative interactions 'where a strategic problem setting is linked to a plausible solution meeting the test of political consensus'.

However, while implications of oversimplification should clearly be taken into account, the policy cycle can be a powerful tool for policy analysis. By breaking down policy development into clear, distinguishable stages, it can make the decision making process more understandable, allowing for useful comparisons and analyses of distinct stages, and helping to identify weaknesses and opportunities in each step of the policy making process.

A typical representation of the policy cycle divides the policy cycle up into 10 phases (see Figure 3.2 below):

Stage 1 - **Problem recognition**: In this stage of the policy cycle, a particular issue is identified by stakeholders and/or political actors as being a 'problem' on which action needs to be taken.

Stage 2 - **Agenda setting:** After acknowledging the problem, policy-makers decide when and who will deal with it and what steps should be taken to address it.

Stage 3 - Problem exploration: At this stage in the policy cycle, the problem is defined – e.g. in relation to size and impact. Assumptions and public opinion can play a critical role in this process.

Stage 4 - Identification of possible solutions: At this stage in the policy cycle, possible solutions (policy options, actions etc.) are identified.

Stage 5 - Analysis of policy options: In this stage, different solutions that have been identified are assessed (regulations, standards, plans, programmes, etc.) with different content, aims, instruments, strategies, responsibilities, funds, etc.

Stage 6 - Selection of policy options: At this stage in the policy cycle, policy-makers choose between the different alternative options.

Stage 7 - Implementation: In this stage of the policy cycle, administrations implement what has been decided by the policy-makers.

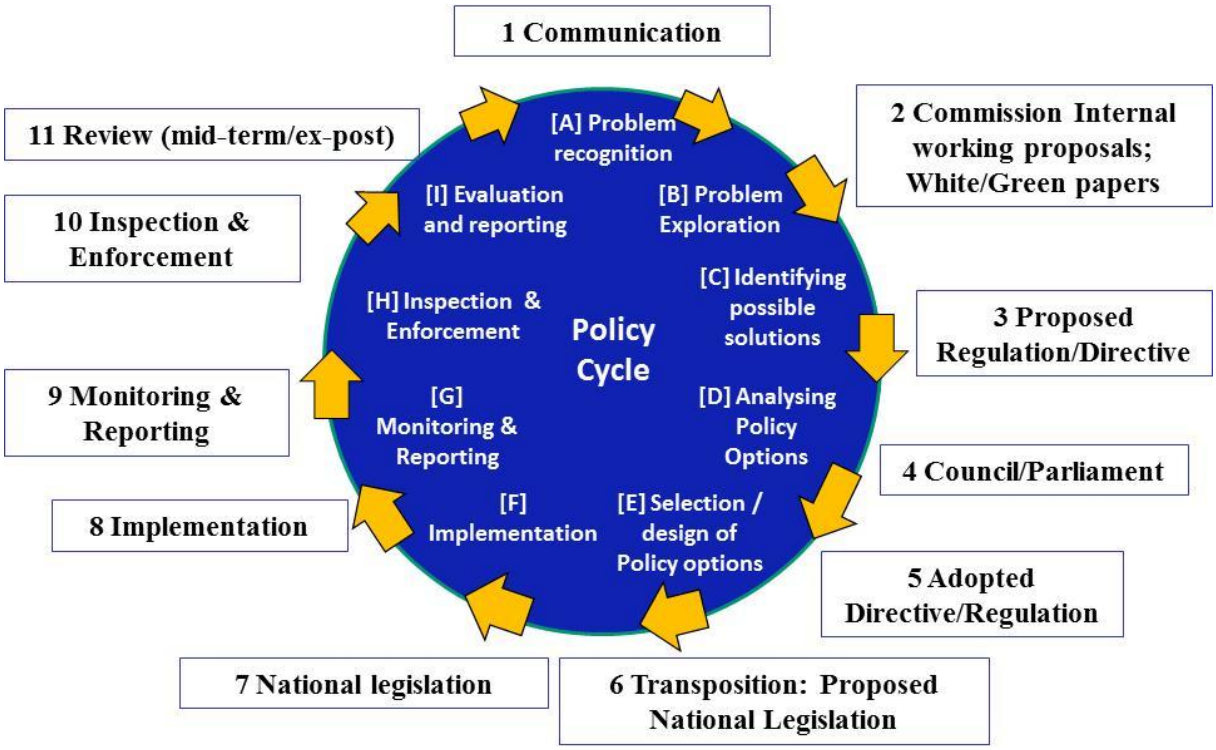
Stage 8 - Monitoring and reporting: Administrations monitor actions and report back to policy-makers.

Stage 9 - Evaluation: At this stage in the policy cycle, the effectiveness of the policy measure is assessed.

Stage 10 - (Dis-)continuation: At this stage, policy-makers decide whether or not a policy measure should be continued.

Different classifications are also possible, and different versions of the policy cycle have been tailored to each policy under analysis – see chapters 4-6 for the full analysis policy by policy.

Figure 3.2 A 10-stage policy cycle



Source: Own elaboration, based on TEEB, 2011

3.4 Step 4: Stakeholders consultation

A consultation with stakeholders was carried out to support the investigation of how the use of indicators can help achieve policy-outcomes consistent with the commitment to sustainable development and, in particular, the integration of the environmental dimension into those different policy-areas. As the work had been structured along the three storylines ('Biodiversity', 'Green growth' and 'Resource efficiency'), the consultation was also structured along three storylines and the associated policy areas.

Stakeholders active in those policy areas at different levels of governance (European and national) and from different groups (policy-makers, statisticians, researchers) working in in one of the specific fields were contacted for an interview structured around a questionnaire tailored around each policy. An example of the questionnaire used is provided in Appendix xx.

The objective pursued through these structured interviews was to better understand which indicators are best suited for ensuring that sustainable development is reflected in the different policy-areas and at which stages of the policy-making processes they are best applied.

The questionnaire therefore aimed to gather information on:

a) Where existing indicators could be used better (e.g. at a different point in the policy cycle) or improved (e.g. better methodology, better data needed)
b) Which new indicators could complement the current list of IN-STREAM indicators known to be used in a given policy area
c) Where composite indicators could have a role to play

Stakeholders' inputs were in particular key for the formulation of conclusions on the level of integration of environmental and socio-economic considerations through the use of indicators in different policy-areas, for producing recommendations with regard to the scope for the use of indicators in different policy areas and for the identification of persisting indicator gaps.

4 Biodiversity and the value of Ecosystem Services

'A country could cut down all its forests and deplete its natural resources and this would show only as a positive gain to GDP despite of the loss of capital'. (MEA, 2005)

Sustainability indicators for **Biodiversity policy:**

- Biodiversity is an umbrella concept whose measurement traditionally involves the simultaneous consideration of species diversity, genetic variability within populations, and the functional diversity of ecosystems. This level of complexity poses considerable challenges regarding the construction of policy-relevant biodiversity indicators. Biodiversity policy should thus be underpinned by a **basket of indicators** that capture the multifaceted nature of biodiversity, to avoid bias towards species, habitats and ecosystem services for which data is most readily available. Indicators should also be able to capture key trends and the risk of breaching critical environmental and resource thresholds.
- The process of developing and adopting EU-wide indicators in the field of biodiversity policy has mainly been driven by the reporting requirements of the **Nature Directives and to the Convention on Biological Diversity (CBD),** and the need to assess progress towards the headline target of halting biodiversity loss. Indicators have so far primarily addressed the environmental pillar of sustainable development, focusing on ecological **status and trends, and impacts** on ecosystems.
- There is a need, on one hand, to address current gaps through **further development of indicators** and, on the other, to **better integrate** the indicators developed by the scientific community into policy-making.
- The post-2010 biodiversity policy marks a **shift in emphasis towards ecosystem services** and the importance of biodiversity for human well-being. This calls for further refinement and development of ecosystem services indicators, in order to estimate trends in their provision and to provide a more complete picture of ecosystem resilience.
- According to the practitioners consulted, indicators in this field are in particular applied at four stages of the policy cycle: problem recognition, problem exploration, monitoring and reporting, and evaluation. There is scope for **further applying indicators in the intermediary stages** of the policy cycle, to identify possible solutions and support impact assessment or cost-benefit analyses of different policy options.
- While it is not always feasible to capture policy responses into a quantifiable indicator, the development of **standardised reporting/analysis** could support the application of qualitative indicators of response.

- Given the close linkages between biodiversity and other sectors, a streamlined set of biodiversity indicators that can be **integrated into several policy areas** should be developed. The use of frameworks like the **Natural capital accounts** (measuring stocks of assets: forests, fish, land as well as soil, water, carbon in soils) and the **System of Economic and Environmental Accounts (SEEA)** have a lot of potential to integrate environmental considerations into policy decision.

Sustainability indicators for **Agriculture policy:**

- In **agriculture**, the importance of **public goods** merits **additional effort in developing biodiversity and ecosystem service indicators,** as well as indicators for social public goods, to ensure that the wider provision of public goods can duly be taken into account in policy decisions, funding, and investments, and in instrument design, implementation, monitoring and evaluation. The use of ecosystem services indicators will also be important to highlight and monitor the benefits provided by ecosystems to agriculture, such as aquifer recharge, flood control, water purification, pollination etc.
    - In the context of the Common Agriculture Policy (CAP), **sustainability indicators are currently used for tracking impacts of the rural development policy** under Pillar 2, which focuses on rural development, as part of a programmed policy approach. They do not play a role under Pillar 1, which encompasses a non-programmed approach focusing primarily on income support, although there the bulk of CAP expenditure lies. This gap needs to be critically interrogated. In the end, both policy streams will have an impact on whether or not agriculture uses the resource base in a sustainable way.
- Additional sustainability indicators would be useful to understand the impacts of agricultural land use in Europe, and would help to identify which measurable sustainability objectives could be set for the CAP Pillar 1. These additional indicators might include, for example, Adjusted Net Savings, the System of Integrated Environmental and Economic Accounting (SEEA-2003), climate change indicators like GHG intensity, or GDP Energy intensity. In particular, it will be useful to explore the feasibility of **using resource indicators, such as the Human Appropriation of Net Primary Productivity (HANPP),** to develop aggregate information on the utilisation of the natural resource-base by agriculture.
- In theory, using indicators within the CAP Pillar 1 to measure environmental outcomes continues to be considered as a challenge. This is because of the **range of exogenous factors** that play an important role in agricultural management, such as the price of commodities and inputs, technological developments, market exigencies, trade issues, bioenergy policies and environmental regulation, as well as the effects of climate change on farming systems. In addition there are issues of additionality and data availability.
- Further efforts are needed to refine and extend the CAP Pillar 2 **Common Monitoring and Evaluation Framework (CMEF)** indicators. More efforts are also required to streamline and harmonise data collection the '**agri-environment'** indicators currently used in the EU-27 Farm Structure Survey and by Eurostat and to progress with the agri-

environment indicators that are under development.

- In particular it is important that implementation of the **mandatory CMEF evaluations of biodiversity and High Nature Value (HNV) farming** improves, as the relevant indicators receive little attention in some Member States, whilst in others significant progress has been made. The robustness of the methods for data aggregation for the HNV indicators needs some improvement too.

Sustainability indicators for **Fisheries policy:**

- The recognition of the over-exploitation of EU fish underlines the importance of having **good indicators to measures stock**, determine **sustainable yields**, set **targets** and **monitor** progress, as well as to measure the performance of the Common Fisheries Policy. Indicators can also be helpful to have a better understanding of the effect of fishing on the marine environment and on ecosystem services, and the impacts of pollution (especially eutrophication) on fisheries. This can be useful to inform not only fisheries policy, but also e.g. agricultural, waste water and municipal waste infrastructure issues and related policies (e.g. Liability Directive[6]).
- The European Commission's DG Mare currently uses a standard set of indicators in the fisheries management policy cycle and these have been developed through a number of research projects. Whilst there is a desire to use indicators at all stages of the policy cycle, the most developed indicators are the ecological indicators describing the state of the ecosystem. There has been progress on identifying social and economic indicators (e.g. used in impact assessment) but there is still a bias towards state and pressure indicators. Despite these developments, more research is needed to understand the **links between pressure and state indicators, pressure and response indicators and the links between the three** types of indicators.
- Indicators to measure 'good environmental status' of European seas are also under development under the Marine Strategy Framework Directive (MSFD). The development of **indicators for monitoring the performance of the CFP and the Marine Strategy Framework Directive (MSFD)** over time will also be needed.
- In order to enhance the use of sustainability indicators, the **Common Fishery Policy (CFP) objectives need to be clearly defined**, allowing for more flexibility at the regional scale to allow for development of **indicators relevant to regions**.
- A broader and more detailed set of data relating to fisheries should be requested to be reported under the **regulation on environmental economic accounts** in its next revision of the Data Collection Framework. In particular, data to support the assessment

[6] Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=2004&nu_doc=35

of cost of over-exploitation and the benefits from efficient management of the aquatic resources exploited by commercial fisheries should be collected.

- If methodological improvements of the **adjusted Net Savings (Genuine Savings)** indicator are to be attempted, consideration for it to take depletion of fish stocks into account should be given.
- The **exchange of information between policy areas e.g. biodiversity and fisheries** should be facilitated in order to make the best use of information beneficial to both.

Biodiversity – the variety of ecosystems, species and genes – is the world's 'natural capital' and its conservation and restoration is a key environmental priority for the EU.

The recently released The Economics of Ecosystems and Biodiversity study (TEEB, 2010) highlights the link between the health of ecosystems and the (often overlooked) value of the important services that these provide. The TEEB for National Policy-Makers[7] (TEEB, 2011), *inter alia*, calls for suitable indicators and/or accounting frameworks to measure our natural capital, and highlights urgent steps to allow the formation of a solid evidence base for informed policy decisions. It calls for: improved measurement and monitoring of biodiversity and ecosystem services; better macro-economic and societal indicators; and more comprehensive National Income accounting.

While it is a very complex task to measure all aspects of **biodiversity**, throughout the past few years an increasing number of indicators have been developed to help communicate trends in biodiversity and ecosystem health to policy-makers. A recent indicator-based assessment by the European Commission (EC, 2010) revealed that, whilst some progress had been made, the state and trends of Europe's biodiversity are still a serious cause for concern, with a wide number of ecosystems and ecosystem service flows having degraded in recent years. For instance, some biodiversity-rich areas like grasslands and wetlands are declining, and up to 25 per cent of European animal species, including mammals, amphibians, reptiles, birds and butterflies face the risk of extinction. It also became apparent that a significant weakness of biodiversity policy instruments was that they failed to establish appropriate indicators, milestones and baselines to measure progress. For instance, the assessment on the EU Biodiversity Action Plan (Herkenrath et al., 2010) required to retro-fit indicators in order to be able to analyse progress towards the target of halting biodiversity loss by 2010.

Having failed to meet its target to halt biodiversity loss by 2010, the EU adopted in 2010 a new target referring to the halt of biodiversity loss and ecosystem services by 2020, which was translated into a new biodiversity strategy to 2020 in 2011. The increasing importance

[7] Chapter 3: Strengthening indicators and accounting systems for natural capital: http://www.teebweb.org/LinkClick.aspx?fileticket=J3_lcRRutGw%3d&tabid=1019&language=en-US

given to the value of biodiversity and the conservation ecosystem services further fuelled the demand for reliable biodiversity and ecosystem services related indicators. As part of this process, the EU has established a solid biodiversity baseline for the year 2010. This will act as a reference point for measuring future changes in biodiversity, for instance as a result of EU policy, though still presenting major gaps on the application of ecosystem services indicators.

Part of the new EU biodiversity strategy will be a daughter strategy on Green Infrastructure, foreseen for 2011. In this regard, the Commission seeks to develop ways to assess its future efficiency. It will be therefore important to identify the best indicators to demonstrate and assess the contribution of different elements of Green Infrastructure to ecosystem resilience and to determine what specific indicators are lacking sufficient data and development.

The EU Fisheries policy also relies on a number of indicators to assess its effectiveness. These include, for instance, the level of fish catches taken from stocks outside 'Safe Biological Limits', which is linked to the indicator of 'Maximum Sustainable Yield' (MSY), and the Marine Trophic Index (MTI). Indicators to quantify and monetise the impacts of fishery policies are also crucial. For instance, concepts and suggestions behind the World Bank's 'The Sunken Billions' report (World Bank, 2009), which estimates the loss of potential economic rent in the global fishery, also offer important insights of the role of sustainability indicators, and were of inspiration for the IN-STREAM analysis.

In the context of the EU agriculture policy, there is clearly a wide range of public goods associated with **agriculture,** many of which are highly valued by society, which fails to be communicated to the general public and to be protected by adequate measures. The most significant of these are environmental - such as agricultural landscapes, farmland biodiversity, water quality, water availability, soil functionality, climate stability (including greenhouse gas emissions and carbon storage), air quality, resilience to flooding and fire - as well as a diverse suite of more social public goods, including food security, rural vitality and farm animal welfare and health. As there is evidence of undersupply in most of the key environmental public goods provided by agriculture, it is crucial that these are appropriately monitored and taken into account in EU and national policies, in particular in the Common Agriculture Policy (CAP). The use of specific indicators for agriculture has and will help keeping track of important trends in the supply and use of public goods. The most relevant indicators are the IRENA agri-environmental indicators finalised in 2005 by EEA (for EU-15). In addition, in its Communication COM(2006) 508 final in 2006, the European Commission adopted 28 agri-environmental indicators (AEIs) to assess the interaction between the CAP and the environment (many of which are still under development). These AEIs, aim to track farm management practices, agricultural production systems, pressures and risks to the environment, and the state of natural resources.

Overall, it is apparent that the importance of biodiversity and healthy ecosystems for human well-being and long term prosperity is increasingly being recognised. The latest developments in EU biodiversity policy, the recent Convention for Biological Diversity (CBD) Conference of the Parties (COP) meeting in Nagoya and the strong attention received by

TEEB in the EU and globally make ecosystem valuation a very crucial and timely topic. Furthermore, the relevance of the CAP in the EU budget and the influence it can have on the improvement of agriculture practices, as well as the importance of the CFP for the sustainability of EU fishery, imply that the use of sustainability indicators has the potential to have a significant impact on the allocation of future funding and on the effectiveness of key EU policies.

4.I Biodiversity policy

4.1.1Key policies where indicators have a role to play

As documented by the 2010 EU Biodiversity Baseline (EEA, 2010a), Europe's biodiversity remains under severe **threat** from habitat and ecosystem fragmentation, degradation and destruction due to land-use change, pollution, over-exploitation, invasive alien species, and climate change. For example, the assessment of the **status** of habitats and species of Community interest found that 65% of habitats have an unfavourable conservation status, with the Pannonian and Atlantic biogeographical regions doing worse than other regions. In addition, more than 50% of amphibians, fish, arthropods, molluscs, vascular and non-vascular plants of Community interest were found to have an unfavourable conservation status. Up to 25% of animal species, including mammals, amphibians, reptiles, birds and butterflies risk extinction. At the global level the loss of biodiversity continues at an even more alarming pace, with 12 to 55 per cent of selected vertebrate, invertebrate and plant groups threatened with extinction, according to the Third Global Biodiversity Outlook (CBD, 2010). It also needs to be considered that our knowledge of the status of habitats and species in Europe and in the world, and the impacts of pressures on them is far from complete (TEEB, 2011). For example, 13% of regional habitat assessments and 27% of regional species assessments under the Habitats Directive are yet reported as 'unknown' (EEA, 2010a).

The before mentioned pressures are underpinned by **drivers** such as demographic and cultural/lifestyle choices, institutional and market failures, economic growth, and trade[8] (MA, 2005). They often involve long-term social and economic trends, and are even more difficult to control regarding their impact on biodiversity (CBD, 2010). Finally, the **impacts** of pressures on species and habitats are also affecting the overall health of ecosystems, including their ability to provide vital ecosystem services, such as those associated with water resources, soils, carbon, flood management, recreation and tourism (MA, 2005; EASAC, 2009). A recent assessment found that Europe's ecosystems are degrading to such

[8] European Commission (2011) Our life insurance, our natural capital: an EU biodiversity strategy to 2020, Commission staff working paper: Impact assessment, SEC(2011) 540

an extent that many are no longer able to deliver the optimal quality and quantity of basic services[9]. As evidenced by the Economics of Ecosystems and Biodiversity (TEEB) study[10], biodiversity loss and ecosystem degradation also entail high economic costs that have been, until recently, largely overlooked.

Given the multitude of pressures affecting biodiversity, the complexity of underlying drivers, and the potential negative impacts for different sectors, the successful implementation of biodiversity policy depends on the **integration** of biodiversity considerations into other sectors. Numerous EU policies - for example, the Common Agricultural Policy, Common Fisheries Policy, cohesion policy and trade policy - have an impact on biodiversity or can benefit from (and sometimes even rely on) ecosystem goods and services. Indicators are therefore essential to ensure that policy makers in other fields take possible impacts on biodiversity into account and quantify the efficiency/effectiveness of integration into different policy areas. The Commission Communication on options for an EU vision and target for biodiversity beyond 2010[11] noted that more efforts are needed 'to engage other sectors systematically in formulating responses to the biodiversity challenge, underpinned by clear indicators to measure progress'.

The following section provides an outline of key biodiversity policies, where indicators have had an important role to play. To a large extent it focuses on EU biodiversity policy, though a discussion of the international context is provided. Given the importance of biodiversity integration, the chapter makes reference to the application of biodiversity indicators in other sectoral policies, e.g. agriculture and fisheries, where this is considered relevant. The use of environmental (including biodiversity) indicators across different policies is further elaborated in the according chapters.

The Nature Directives and Natura 2000

The Birds Directive[12] and Habitats Directive[13], together with the associated Natura 2000 network, provide the backbone of EU nature conservation and biodiversity policy. The Birds Directive adopted in 1979 established a protection regime for all bird species naturally occurring in the EU, including the designation of Special Protection Areas for birds included in Annex I and considered endangered, vulnerable, rare or endemic. The approach was complemented in 1992, with the adoption of the Habitats Directive which requires Member

[9] www.rubicode.net

[10] http://teebweb.org/

[11] European Commission (2010) Options for an EU vision and target for biodiversity beyond 2010. Communication from the Commission, COM(2010)4 final.

[12] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version of Directive 79/409/EEC)

[13] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora

States to maintain or restore, at favourable conservation status, natural habitats and species of wild flora and fauna of Community interest, as listed in Annexes I and II respectively. Under the Habitats Directive, Member States are required to monitor the conservation status of habitats and species of Community interest found within their territory and to present a report every six years on the implementation of measures foreseen in the Directive (Article 17 reporting). The related indicator (IN-STREAM indicator - Favourable Conservation Status) aims to assess whether habitat and species of Community interest are in favourable or unfavourable (inadequate and bad) ecological condition, or whether the status is unknown, and what trend can be expected. Similarly, the Birds Directive envisages reporting by Member States every three years, though no related indicator assessing the status of Annex I species has been developed. Given the Birds Directive addresses the general protection of all wild birds, the Common Bird Index (IN-STREAM indicator – Pan European Common Bird Monitoring Scheme) is frequently used as tool for measuring achievements towards the objectives of the Directive.

Two main means are used to ensure favourable conservation status: the development of a coherent European ecological network (Natura 2000) comprising Special Areas of Conservation (SACs) hosting habitats and species of Community interest and Special Protection Areas (SPAs) for Annex I birds, and a strict system of species protection.

Article 6 of the Habitats Directive requires Member States to avoid damaging activities within Natura 2000 sites that could significantly disturb species or deteriorate habitats for which the sites have been designated. This presupposes the use of indicators of disturbance and deterioration in order to determine the damaging potential of various activities. Plans or projects which individually or in combination with others are likely to have a significant effect on a Natura 2000 site, but are not directly connected to their management (for nature conservation), are to undergo an Appropriate Assessment of their implications for the site. The competent authorities can only agree to the plan or project after having ascertained that it will not adversely affect the integrity of the site concerned. A plan or project receiving a negative assessment may still be authorized if no alternative solutions exist and there are ‘imperative reasons of overriding public interest’, including those of a ‘social or economic nature’. In such cases, the Member State must take all compensating measures necessary to protect the overall coherence of Natura 2000. Indicators can have a role to play in the Appropriate Assessment when evaluating the impact of developments on the Natura 2000 site, but also to determine whether ‘imperative reasons’ justify authorization despite negative effects and to assess the appropriateness of compensatory measures.

The global and European 2010 target

Following the entry into force of the Convention on Biological Diversity (CBD) in 1993, growing awareness of biodiversity loss and its implications led to a global commitment to significantly reduce the rate of biodiversity loss by 2010, set out in the Strategic Plan adopted by Parties to the CBD in 2002 and endorsed by the World Summit on Sustainable Development in Johannesburg the same year. Similar targets were adopted at national and

regional levels, with the EU committing to an even more ambitious goal of halting the loss of biodiversity in the EU by 2010 and restoring habitats and natural systems already the year before, in 2001. To this end, a detailed EU Biodiversity Action Plan adopted in 2006 set out ten priority objectives specified by 154 actions, grouped around four main policy areas: biodiversity in the EU; the EU and global biodiversity; biodiversity and climate change; and the knowledge base. The Biodiversity Action Plan addressed the challenge of integrating biodiversity concerns into other policy areas, setting out targets and actions with regard to agriculture and rural development, forest policy, fisheries and marine policy, regional and territorial development, as well as external policies such as trade and development cooperation.

The adoption of the 2010 targets at various levels stimulated efforts in developing indicators to monitor progress in meeting this objective (Jones et al, 2011). A first set of CBD indicators was adopted in 2004, during the 7th Conference of the Parties to the CBD. The EU followed suit, setting in motion a process for streamlining European biodiversity indicators (SEBI) in 2005. The SEBI initiative sought to link the global framework set by the CBD and developed by the responsible Ad Hoc Technical Expert Group (AHTEG) with EU regional and national indicator initiatives. A first set of 26 indicators was selected in 2007, following an extensive stakeholder consultation process on initially 140 possible indicators. In the applied framework some SEBI indicators reflect the status and trends of specific biodiversity components (e.g. the abundance and distribution of selected species), while others denote key threats to biodiversity (e.g. trends in invasive alien species), its sustainable use (e.g. quantity of forest deadwood) or ecosystem integrity (e.g. fragmentation of natural and semi-natural areas). The main concerns when developing the set of indicators was to ensure that they are robust and have broad geographical scope, as well as making full use of data derived from the regular assessments of the EU Biodiversity Action Plan (EU BAP) and reporting obligations under relevant EU legislation (European Commission, 2010).

The mid- and full-term assessments of the Biodiversity Action Plan's implementation revealed that, despite sporadic progress, ecosystems and their services continue to deteriorate.[14] Underpinning studies also highlighted that a major failure of the EU BAP was related to the lack of appropriate indicators and baselines to measure progress. It was often necessary to retrofit indicators, and not always was it possible to identify appropriate ones for several targets and actions as many of the objectives to be achieved were not sufficiently measurable and time-bound (Herkenrath et al, 2010).

Based on data resulting mainly from the first assessment of the conservation status of habitats and species protected under the Nature Directives, the European Red List, and several other SEBI 2010 indicators, the EEA released in June 2010 an EU Biodiversity Baseline to support the development of post-2010 biodiversity policy. The baseline sets out

[14] European Commission (2010) *The 2010 assessment of implementing the EU Biodiversity Action Plan*. Communication from the Commission, COM(2010)548 final.

the current state of biodiversity in the EU and indicators to measure and monitor progress and achievements from 2011 to 2020.

A new global strategic plan and the new EU Biodiversity Strategy to 2020

Following the failure to meet the global 2010 target (CBD, 2010), a Strategic Plan for the post-2010 period (Aichi targets 2011-2020) was adopted by the 10th Conference of the Parties to the CBD in October 2010. The new global mission requires Parties '*to take effective and urgent action to halt the loss of biodiversity in order to ensure that, by 2020, ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication*'[15].. Already in March 2010, the EU had adopted its own new headline target of '*halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU's contribution to averting global biodiversity loss*.' In line with this objective and the Union's commitments under the CBD, a new EU Biodiversity Strategy was published in May 2011.[16] The strategy includes six mutually supportive and inter-dependent targets on conserving and restoring species and habitats, maintaining and enhancing ecosystems and their services, ensuring the sustainability of agriculture, forestry and fisheries, combatting invasive alien species, and stepping up the EU's contribution to global biodiversity. The annex to the Communication sets out a package of actions and measures designed to respond to the specific challenges addressed by each target. The strategy is intended to form an integral part of the Europe 2020 Strategy[17] and to contribute, in particular, to its targets on climate change, innovation, and employment.[18] It also aims to improve the integration of biodiversity into other key policy areas, through targets and actions that specifically address the impact of the agriculture, forest and fisheries sectors on biodiversity conservation and sustainable use.

4.1.2 Use of sustainability indicators at present

Biodiversity is an umbrella concept whose measurement traditionally involves the simultaneous consideration of species diversity, genetic variability within populations, and the functional diversity of ecosystems (Levrel, 2007, Reid et al, 1993). This level of **complexity** poses considerable challenges regarding the construction of policy-relevant

[15] CBD COP 10 Decision X/2 on a Strategic Plan for Biodiversity 2011-2020 (Aichi targets) http://www.cbd.int/decision/cop/?id=12268

[16] European Commission (2011) Our life insurance, our natural capital: an EU biodiversity strategy to 2020. Communication from the Commission, COM(2011) 244 final).

[17] European Commission (2010) EUROPE 2020. A strategy for smart, sustainable and inclusive growth. Communication from the Commission, COM(2010) 2020 final.

[18] European Commission (2011) Cur life insurance, our natural capital: an EU biodiversity strategy to 2020, Commission staff working paper: Impact assessment, SEC(2011) 540

biodiversity indicators, as according to Chevassus-au-Louis et al (2009) such indicators would need to:

- report, from a limited number of easily observable entities, on a much larger whole that remains largely unknown;
- describe different levels of organisation of biodiversity (genetic, species, ecological) that do not obey common metrics;
- go beyond the inventory of entities, to take account of the importance of interactions between them, whether in the short term as the basis for ecosystem services or in the long term as a motor for adaptation (i.e. resilience);
- appreciate and measure, on a human scale, variations in biodiversity and the factors responsible for such variations.

The **issue of scale** (in terms of both space and time) poses a particular challenge. Different indicators are needed to inform decision-making at various levels, from local to global, and some measurements may change too slowly with time to provide the immediate information needed for policy and management decisions (Reid et al, 1993).

It is difficult to derive an indicator that reliably covers all facets of biodiversity simultaneously (EASAC, 2004), and allows addressing all different challenges in measurement. For example, the Red List Index mainly addresses extinction risks whereas biodiversity losses of more common species are not captured. In addition, very species-rich taxonomic groups such as insects are only poorly covered (see IN-STREAM D2.2 Report). Recent efforts have therefore been concentrated on developing and agreeing on a **basket of indicators** that by complementing each other jointly capture biodiversity's multiple dimensions and potential interactions. The use of an **analytical framework** has often provided a conceptual basis for the development of such a basket, as it can help to provide a logical structure to the analysis and communication.

According to the CBD Secretariat[19], for example, indicators should allow policy-makers to answer five key questions regarding the implementation of the Convention on Biological Diversity:

- What is changing and to what extent? (state);
- Why is it changing? (pressure/threat);
- Why is it important? (use);

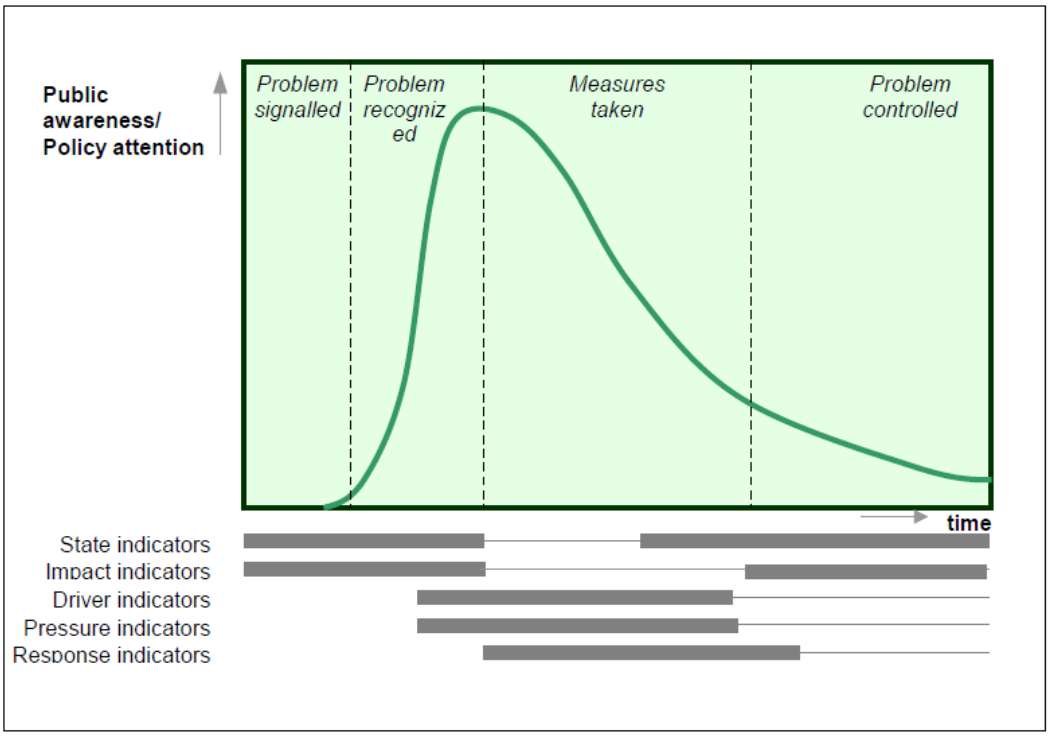
[19] http://www.cbd.int/indicators/questions.shtml

- What are we doing about it? (response);

- Do we have the means to formulate and implement response measures? (capacity).

The questions above aim to identify indicators that not only address status and trends of different biodiversity components, but also take into account pressures leading to their loss and responses taken to counteract those pressures. They are a reflection of the pressure-state-response framework for environment indicators developed by the OECD in the 1990s and the further advanced **DPSIR** (drivers-pressures-status-impact-response) framework for developing policy-relevant environmental indicators created by the EEA (Gabrielsen and Bosch, 2003). According to this approach, social and economic developments (*drivers*) exert *pressure* on the environment (including biodiversity), changing the latter's *state*. These changes lead to *impacts*, for example, on ecosystems that may elicit a societal *response* which feeds back on the drivers, pressures, states or impacts directly, through adaptation or curative action (Gabrielsen and Bosch, 2003). According to the authors, the relevance of environmental indicators from different parts of the DPSIR framework depends on the **stage of the policy cycle** to which they are applied (see Figure 4.1).

Figure 4.1 DPSIR indicators and the policy life cycle



Note: over time environmental problems pass through a policy life cycle with first increasing, and as the problem is more controlled, decreasing attention of the public and policy-makers. The horizontal bars under the graph illustrate the relative role of DPSIR-indicators in this process. The 'linkage' indicators in-between the DPSIR elements follow more or less the same pattern.

Source: Gabrielsen and Bosch, 2003

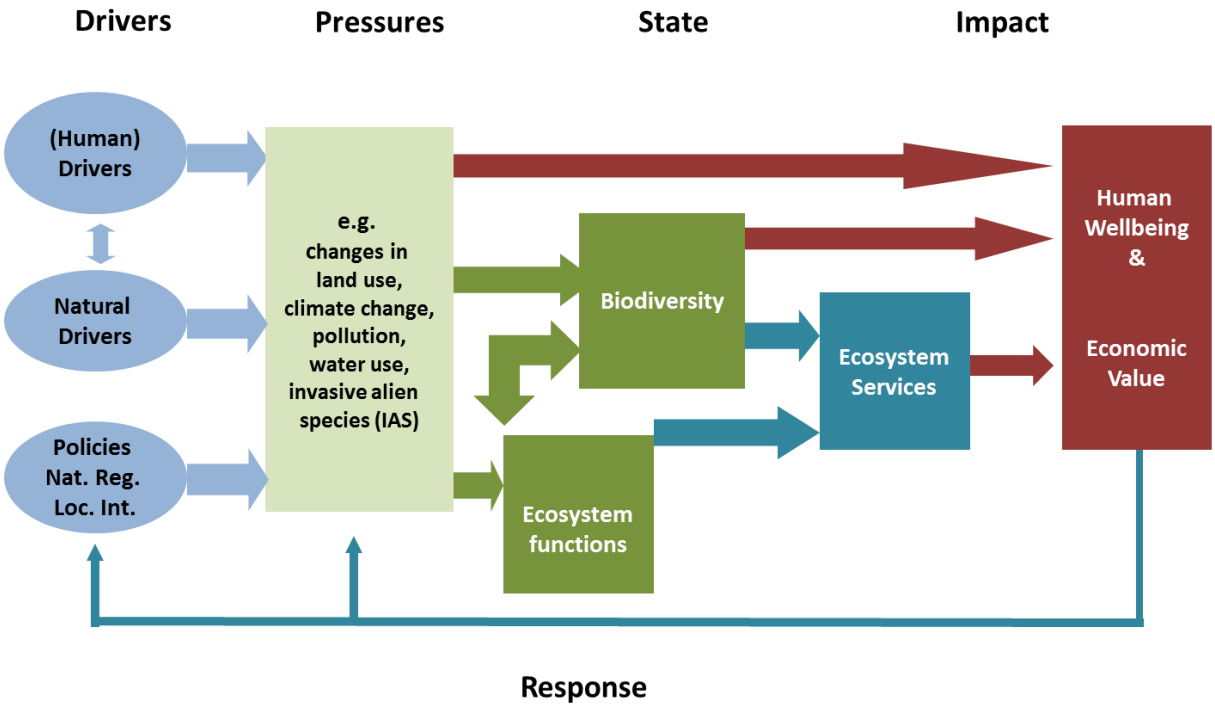
Indicators on state and impacts, for instance, play a major role in the problem identification phase. At subsequent stages (formulation of policy responses, implementation of measures) policy-makers focus on the elements policy can influence, i.e. drivers and pressures. Performance (or policy-effectiveness) indicators on changes in drivers and pressures are therefore necessary at these stages. State and impact indicators become important again in the monitoring phases (Gabrielsen and Bosch, 2003).

The DPSIR is certainly one of the most well-known approaches though other analytical frameworks exist that can be applied for the development of biodiversity indicators, much depending on the purpose for developing such a list. It ranges from the simple definition of focal/key areas to measure achievements against targets or the use of a logical framework structure that addresses inputs, processes, output, outcome and impact at different levels (e.g. policy and project level). However, it is also generally argued by Bubb et al. (2011) that the application of analytical frameworks has its value mainly when determining the purpose and needs for biodiversity indicators, but less at later stages given their multiple purposes depend on interpretation and need, and policy area.

It needs to be considered that indicators traditionally applied to EU biodiversity policy have primarily addressed the environmental pillar of sustainable development, focusing on ecological status and trends, and impacts on ecosystems. However, the post-2010 biodiversity policy marks a shift in emphasis towards ecosystem services and the importance of biodiversity for human well-being. For instance, the second target of the new Biodiversity Strategy, on maintaining and restoring ecosystems and their services, introduces a range of new actions and measures, such as mapping and assessing the state of ecosystems, their services and economic value, the development of a green infrastructure strategy, a no net loss initiative and the development of a methodology to 'biodiversity proof' EU funded projects, plans and programmes.[20] This growing focus on ecosystem services and the economic value of biodiversity marks a closer integration of the **social and economic dimensions** of sustainability into biodiversity policy, alongside environmental considerations. Instead of only taking into consideration the **impact** of biodiversity loss on ecosystems, impacts on human well-being become an important component to be integrated in the DPSIR framework (see Figure 4.2).

[20] European Commission (2011) Our life insurance, our natural capital: an EU biodiversity strategy to 2020. Communication from the Commission, COM(2011) 244 final.

Figure 4.2 DPSIR and ecosystem services



Source: TEEB, 2011

The ecosystem services approach provides a new bridge between the EU's nature conservation policies and other sectoral policies (e.g. agriculture, energy, regional development) (TEEB 2011). It offers further opportunity for integration, but also bears risks that need to be taken into consideration. The use of ecosystem services indicators therefore forms an important part of this analysis.

The following sections will look into the current use of biodiversity and ecosystem services indicators in the policy cycle (including those identified in the context of IN-STREAM and beyond), the application of analytical frameworks, and limitations of existing baskets.

Current use of indicators in EU biodiversity policy

The process of developing and adopting EU-wide indicators in the field of biodiversity policy has mainly been driven by the reporting requirements of the nature directives and to the CBD, and the need to assess progress towards the headline target of halting or significantly reducing biodiversity loss. As revealed by questionnaires sent to experts in the policy field and discussions during one of the project workshops[21], indicators in this area therefore have

[21] Instream Workshop – Sustainability Indicators for Policy Making. Report on the workshop of 8-9 February 2011

in particular been applied at the **monitoring and reporting** and **evaluation and reporting phases** of policy development. Originally, this very often included indicators that measure **biodiversity status and trends** (e.g., Common Bird Index, the Red List Index or Favourable Conservation Status), due to the main objective of getting a better understanding of what is happening to biodiversity (and related availability of data) and to communicate the urgency for action. In order to get a more comprehensive picture not only on the current situation and future trends but also on the reasons for change and on the likely impacts, the set of indicators was enlarged, to provide inter alia information on **key threats** (e.g. invasive alien species, impacts of climate change, nitrogen load excess), ecosystem integrity (e.g. fragmentation of river systems, freshwater quality) or the **sustainable use** of its components (e.g. HNV farmland; forest growing stock, increment and fellings). The SEBI indicators had as objective to show the extent to which the 2010 target was met for specific elements of biodiversity, but also focused on revealing problems requiring a policy response by including information on key threats. The following figure provides an overview of the 26 SEBI indicators, following the key focal areas identified by the CBD (e.g. status and trends, key threats, sustainable use, resource transfer).

Figure 4.3: SEBI indicators and areas of focus

Status and Trends	1. Abundance and distribution of selected species **a)Birds** b)Butterflies	& ESS	14. Fragmentation of river systems
	2. Red List Index for European species		15. Nutrients in transitional, coastal and marine waters
	3. Species of European interest (FSC)		16. Freshwater quality
	4. Ecosystem coverage	Sustainable use	17. Forest: Growing stock, increment and fellings
	5. Habitats of European interest (FSC)		18. Forest: Deadwood
	6. Livestock genetic diversity		19. Agriculture: Nitrogen balance
	7. Nationally designated protected areas		20. Agriculture: Area under management practices potentially supporting biodiversity
	8. Sites designated under the EU Habitats and Birds Directives		21. Fisheries: European commercial fish stocks
Threats	9. Critical load exceedance for nitrogen		22. Aquaculture: Effluent water quality from finfish farms
	10. Invasive alien species in Europe		23. Ecological Footprint of European countries
	11. Impact of climate change on birds populations	Other	24. Patent applications based on genetic resources
Integrity	**12. Marine Trophic Index of European seas**		25. Financing biodiversity management
	13. Fragmentation of natural and semi-natural areas		26. Public awareness

Note: IN-STREAM indicators highlighted in **bold.**
Source: based on EEA, 2010b

As regards the application of indicators for EU biodiversity policy, it needs to be considered that one of its important instruments, the 2006 Biodiversity Action Plan, did not define a baseline against which achievements are to be assessed and also the means of assessing progress were not defined at the outset. To measure progress in its delivery, it was therefore necessary to identify and work backward to fit indicators from existing data sources, including SEBI indicators. A detailed assessment of the BAP was undertaken in 2009 to identify indicators ('Measures of Progress') and their data sources for each action. The assessment revealed that indicators could not easily be applied for nearly a quarter of the actions included in the plan, as targets were not developed for a specific, measurable, achievable, relevant and time-bound output (SMART) (Herkenrath et al, 2010). In addition, the action plan was not structured according to an analytical framework of status, key threats, responses and impacts, but focused on key areas to guarantee the integration of biodiversity into other policy areas. Targets and actions largely addressed the implementation of relevant **responses** rather than the achievement of a specific status or reduction of impacts (Herkenrath et al, 2010). In this regard it quite differs from the SEBI indicators, which put a stronger emphasis on status and key threats and less on responses. It might also explain why experts consulted in the context of IN-STREAM could identify only a few indicators that can be located in the **solution seeking** and **analysis phase** of policy development. This mostly included indicators on protected areas (e.g. number and area of SCIs and SPAs, state of progress in reaching sufficiency, nationally protected areas).

To compile adequate information for the 2010 report on the implementation of the BAP, the assessment mainly gathered information on Member States' progress in addressing biodiversity loss, i.e. on policy responses and management measures. This entailed few quantifiable indicators (e.g. percentage of Natura 2000 sites with a management plan completed or in preparation, number of action plans per species group, number of legal cases related to Article 6 of the Habitats Directive, expenditure for management or restoration of Natura 2000 sites), but several yes/no questions on the existence of specific legislation or national strategies and action plans (e.g. on invasive alien species, conservation of genetic resources, access and benefit sharing) and qualitative descriptions of the implementation of certain measures (e.g. the tools in place to support ecological connectivity)[22]. Although it would be preferable to use standardised quantitative indicators of responses to allow comparison between Member States and EU-wide assessment, the BAP reporting exercise highlights that it is not always feasible to capture the necessary information on implementation into a quantifiable indicator. However, where this is the case the development of standardised reporting/analysis could support the application of **qualitative indicators of response**. Not always quantitative information is necessarily better than qualitative, particularly when measuring the multiple dimensions of responses. Related examples can be particularly explored outside environmental policy, where in the context of human rights assessments standardised country reports are used to develop such indicators (e.g. based on scores). In the context of climate change, the climate change

[22] European Commission (2010) EU Biodiversity Action Plan Report 2010. Country Profiles, http://ec.europa.eu/environment/nature/biodiversity/comm2006/bap_2010.htm

performance index[23] not only uses data on carbon dioxide emissions but also explores national and international policy by gathering judgment and scores from a range of experts.

Nevertheless, the absence of easily quantifiable targets was seen as one of the reasons for the lack of success of the BAP. In its conclusions of 15 March 2010, the Council indicated that the EU post-2010 biodiversity strategy should, *inter alia*, be based on a limited number of ambitious, realistic, achievable and measurable sub-targets for different ecosystems, driving forces, pressures and responses; ensure the integration of these targets into relevant sectoral policies; set a clear baseline outlining the criteria against which achievements are to be evaluated; and strengthen the assessment tools and indicators.[24] The new EU biodiversity strategy aims to overcome the shortcomings of the previous BAP by setting out quantifiable targets that lend themselves to the use of indicators. It has succeeded in setting more **specific and quantifiable objectives** (e.g. restoring at least 15 per cent of degraded ecosystems). Those have also been put in relation to the different elements of the DPSIR framework, linking some of the specific objectives to several elements (e.g. agriculture & forestry target links to pressures and responses). However, it should also be noted that the length of some targets and their ambiguous wording leaves much room for interpretation (e.g. target on conserving and restoring nature).

The impact assessment accompanying the post-2010 biodiversity strategy emphasises the importance of subsequently developing a **logical framework** 'to monitor trends and assess progress on the measures and targets in a coherent way, based on **clear baseline** and **streamlined set of agreed indicators**'. An EU Biodiversity Baseline was developed by the EEA in 2010, strongly building on the SEBI indicators and the Europe Corine land cover update. Also the initial list of indicators proposed in the impact assessment of the new strategy is largely based on the existing SEBI indicators. Some indicators of ecosystem benefits (e.g. growth and employment attributable to protected areas, ecosystem restoration and green infrastructure) were taken into consideration when crafting the new strategy. However, as discussed in more detail below, the strategy's new emphasis on the benefits of biodiversity and healthy ecosystems to human well-being implies a closer integration of the socio-economic dimension of sustainability into biodiversity policy and increases the demand for new indicators, in particular of ecosystem services.

Amongst the **indicators** that underwent a qualitative analysis in the **IN-STREAM** project, the Common Bird Index, Red List index, Favourable Conservation Status and Marine Trophic index are all included in the SEBI set of indicators used to monitor biodiversity trends and progress towards EU biodiversity conservation targets. The Favourable Conservation Status indicator relates specifically to the overall aims of the EU Habitats Directive (92/43/EEC), which is to maintain or achieve favourable conservation status (FCS) of species and natural

[23] http://www.germanwatch.org/klima/ccpi11.pdf

[24] Environment Council Conclusions of 15 March 2010, http://register.consilium.europa.eu/pdf/en/10/st07/st07536.en10.pdf

habitats of Community interest. Pursuant to Article 17 of the Directive, Member States are under the obligation to report to the European Commission every six years on the condition of habitats and species of Community importance found within their territory. Though being the principle measure of performance of the Habitats Directive (next to indicators on the number and area of Natura 2000 sites), the indicator has not fully entered core sets of indicators of **policy areas** impacting and/or relying on biodiversity, including agriculture, fisheries or cohesion policy. Main arguments for not applying the indicator for example in relation to agriculture policy refer to its time lag in measuring the impact of policy implementation on the outcome for biodiversity on the ground, and secondly, to the indicator being potentially influenced by other factors beyond agricultural policy (see related chapter on agriculture policy). On the other hand, the Common Bird index is applied as a baseline indicator for agricultural policy, being perceived as more amendable to change. Red List index and Marine Trophic index are also used in the context of annual assessments of EU fisheries by ICES (see related chapter on fisheries policy). The Potentially Disappeared Fraction indicator is not currently used in EU biodiversity policy, and also beyond. Among the composite environmental indicators analysed in the framework of IN STREAM, only the Ecological Footprint was identified as used by practitioners interviewed as part of this research. It is included in the set of SEBI indicators, but also applied in the context of resource use. The respondents indicated that IN-STREAM economic indicators (e.g. GDP) and indicators of well-being (e.g. human development index) are currently not used in developing biodiversity policy and monitoring its implementation.

With regard to the use of biodiversity indicators beyond EU biodiversity policy particularly at the stage problem exploration and possible solutions, the application of **integrated assessments** to the European Commission's new policy initiatives has also a role to play. The assessment includes an analysis of the economic, social and environmental impacts of the different policy options. The Impact Assessment Guidelines[25] for Commission staff mention biodiversity, flora, fauna and landscapes in the set of key questions to be addressed when screening for environmental impacts. The questions proposed by the guidelines with regard to biodiversity are:

- Does the option reduce the number of species/varieties/races in any area (i.e. reduce biological diversity) or increase the range of species (e.g. by promoting conservation)?

- Does it affect protected or endangered species or their habitats or ecologically sensitive areas?

- Does it split the landscape into smaller areas or in other ways affect migration routes, ecological corridors or buffer zones?

[25] European Commission (2009) Impact Assessment Guidelines. SEC(2009) 92

- Does the option affect the scenic value of protected landscape?

To better understand what kind of biodiversity indicators are applied to what the extent in the assessments a more thorough analysis would be needed. However, the questions above indicate a strong focus on biodiversity state indicators (in particular on species) and it is likely that for other questions mostly qualitative information is used.

A number of biodiversity-related indicators have been included in the set of **sustainable development indicators** (SDI)[26] designed to provide a statistical picture of progress in reaching the objectives of the EU Sustainable Development Strategy. The indicators retained under the Natural Resources theme of the Strategy include two headline indicators - Common Bird Index; Total fish catch taken from stocks outside safe biological limits - followed by indicators referring to:

- Biodiversity: Sufficiency of sites designated under the EU Habitats Directive; deadwood in forest land;

- Freshwater resources: Surface- and groundwater abstraction as a share of available resources; population connected to urban waste water treatment with at least secondary treatment; biochemical oxygen demand in rivers;

- Marine ecosystems: Size of fishing fleet;

- Land use: Built-up areas; forest increment and fellings; forest trees damaged by defoliation.

Several SEBI indicators are also part of the EEA Core Set of Indicators[27] and the Environmental Policy Review to monitor progress in the implementation of the EU Sixth Environment Action Programme[28] (e.g. response indicators such as Natura 2000 areas, area under agri-environmental commitment, and state indicators such as Common Bird index and FCS) (SEBI Coordination Team, 2011).

Limitations of existing baskets

The previous sections already referred to some of the challenges linked to the application of biodiversity indicators, from the **complexity** of the topic to the issue of **time scale**, the lack

[26] http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators

[27] http://www.eea.europa.eu/en/publications/technical_report_2005_1/CSI-tech1_2005_FINAL-web.pdf

[28] http://ec.europa.eu/environment/policyreview.htm

of **response indicators** or indicators linked to solution seeking and policy development, and difficulties of **integration**. The following section further outlines and summarises existing limitations and potential needs for indicators in biodiversity policy.

The SEBI Working Group on Interlinkages between the European Biodiversity Indicators underlined the poor representativeness of the current **state indicators** in the SEBI set and the need to include additional species groups beyond birds and butterflies and additional genetic resources (EEA, 2011). More generally, data gaps persist with regard to individual elements of biodiversity in the EU, e.g. data on marine species and habitats, invertebrates, soil biodiversity. The conservation status of habitats and species listed in the Habitats Directive was reported as 'unknown' for 18% of habitat types assessed and 31% of species, indicating a significant lack of quantitative and qualitative data at Member State level (EEA, 2010a). Regarding pressures and threats, the 2010 EU Biodiversity Baseline report and TEEB (2011) underscored the need for further research on ecosystem **'tipping points'** and 'planetary boundaries' to provide information on the resilience and relative health of species or habitats, allowing prioritisation of conservation measures. Driver indicators such as population growth, consumption, and production efficiency are not included in the SEBI set, but are available from other sources and could be considered in policy analyses, as appropriate (EEA, 2011).

Indicators of ecosystem services in the SEBI set are limited to a few provisioning services, such as commercial fish stocks and timber yields. In addition, current indicators under the **'Sustainable Use'** focal area can only provide an incomplete picture of the extent to which fisheries, forests and agricultural ecosystems are sustainably managed and critical levels are yet to be determined for such indicators (EEA, 2011). The SEBI Expert Group on sustainable use of forests, marine and agricultural ecosystems recommended the addition of socio-economic indicators, e.g. employment and gross value added per sector, to assess sustainable use of biodiversity (EEA, 2011).

In addition to reflecting status and trends, indicators should provide an indication of the relative effectiveness of different policies and act as 'a lever for taking measures' (EASAC, 2005). The information captured by the indicators must therefore indicate cause-effect relationships (e.g. between pressures and state, or response and pressures) in order to provide policy-makers with a reliable trigger for action (EASAC, 2005). To inform the selection and design of new policies, indicators should tell us not only where we stand with regard to the targets set, but also *why* we have missed or successfully reached certain targets. Existing indicators can only partly answer this question. The SEBI indicators, for example, provide only a limited picture of policy responses to address biodiversity loss. They include nationally designated protected areas, Natura 2000 coverage, agricultural areas under management practices potentially supporting biodiversity, and biodiversity financing by the LIFE instrument. More information is needed on the effects of conservation measures, management and funding on biodiversity (EEA, 2010a). As Jones et al (2011) note, if indicators are to inform policy choices, the likely response of an indicator to policy measures should be known at least qualitatively. This requires 'an understanding of the mechanisms that link policy change to changes in biodiversity, the effect of these changes on the

indicator, and the role of other drivers of biodiversity change' (Jones et al, 2011). Ideally, indicators should be feeding back information into the problem recognition and problem exploration phases not only in biodiversity policy but also other policy areas, pointing to the need for renewed targets and additional policies to address remaining gaps in legislation and implementation.

Overall, the SEBI Working Group on Interlinkages between the European biodiversity indicators noted that the SEBI basket does not offer a **coherent picture**, given that it draws largely on existing data and indicators developed for different purposes by various institutions (EEA, 2011).

Similar limitations have been highlighted with regard to the CDB set of indicators, on which the SEBI basket is modelled. A framework of goals, targets, and provisional indicators to assess progress towards the 2010 global biodiversity target was adopted by the 7th meeting of the Conference of the Parties (COP) to the CBD in 2004. The set was further developed by the CBD Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) and a refined framework of 22 headline indicators was adopted at the 8th meeting of the COP in 2006 (UNEP-WCMC, 2009). Parties to the Convention were encouraged to apply this framework in their national reporting. Despite continuous progress in improving the framework and data coverage, particularly in the context of the 2010 Biodiversity Indicator Partnership[29] established for this purpose in 2005, a number of shortcomings and challenges have been identified. Many of the indicators were found to have patchy coverage, either geographically or in terms of content (CBD, 2010). The indicator set was deemed incomplete particularly with regard to sustainable use, the quality of ecosystems and biomes, ecosystem services, and the links to human wellbeing (UNEP-WCMC, 2009). The lack of reference values for quantifying the significance of changes made it difficult to measure progress and distance to the 2010 target (CBD, 2010). As linkages between the indicators are not sufficiently reflected in the framework, they do not tell a coherent story about the overall state of biodiversity and the impacts of pressures and policy responses (UNEP-WCMC, 2009). Moreover, the CBD indicator framework is primarily structured around the Convention's priorities, which might hinder its **uptake** and use within other policy sectors or environmental governance processes (CBD, 2010).

Ecosystem Services Indicators

The BAP did not set out any explicit targets or measures aimed at addressing ecosystem services at the EU or global level, nor did it place an emphasis on maintaining the overall health and integrity of ecosystems (Herkenrath et al, 2010). Consequently, the indicators used in its assessment are not sufficient with regard to the second component of the post-2010 headline target – *halting the degradation of ecosystem services*. The increased focus on ecosystems and ecosystem services in the new biodiversity strategy demands suitable

[29] http://www.bipindicators.net/

indicators to estimate trends in the provision of ecosystem services and to provide a more complete picture of ecosystem resilience.

Many of the CBD and SEBI indicators are area-based **proxies** of biodiversity, based on the assumption that biodiversity increases with increasing habitat area (Feld et al, 2010). Such proxies, however, focus on the species richness and abundance component of biodiversity and tend to overlook the compositional, structural, functional and genetic components (Feld et al, 2010). A growing body of scientific evidence suggests that it is functional diversity, rather than species diversity *per se*, that enhances ecosystem functions (Loreau et al, 2001). Redundancy of functional traits (i.e. the presence of more than one species performing the same functional role in an ecosystem process) has been shown to increase resilience and to help maintain ecosystem services (TEEB, 2010).Current biodiversity indicators are therefore insufficient to inform policy aimed at ensuring the sustainable provision of ecosystem goods and services, since they rarely account for the ecosystem functions and processes that underpin such services (Feld et al, 2010).

A study funded under the Sixth Framework Programme, 'Rationalising biodiversity conservation in dynamic ecosystems' (RUBICODE), concluded that the majority of existing indicators (in Europe and beyond) assess trends in biodiversity and habitat quality for monitoring local or sectoral conservation strategies, but do not address ecosystem services directly (Anton et al, 2010). Similarly, a review of the indicators used in the Millennium Ecosystem Assessment and its sub-global assessments highlighted that available indicators for most ecosystem services are not comprehensive and are often inadequate to fully capture the diversity and complexity of the benefits ecosystems provide (Layke, 2009).

The reviewed indicators were ranked based on their ability to convey information and data availability. Results showed that the indicators for regulating and cultural services lagged behind provisioning services in terms of both of the above criteria (Layke, 2009). This is not surprising given that provisioning services are tangible goods that allow for quantification and have been incorporated into marketed commodities (TEEB, 2011). Regulating services, on the other hand, generally represent processes, making quantification more complex. Layke's analysis also showed that indicators were more advanced for services that were traded or subject to government regulation, suggesting that 'demand and supply of indicators go together.' Another challenge to identifying suitable indicators for regulating services is that in certain cases the indicator would be a measure of avoided change. This entails measuring a negative occurrence that has not happened due to the contribution of a regulating service (Layke, 2009).

Some ecosystem services indicators have been developed within other policy areas (many provisioning services such as timber production, livestock production), but their application remains fraught with difficulties. For example, the relationship between biodiversity component and service provided is not yet clear or the indicators used may respond to changes in pressures too slowly to allow policy-makers to measure the impacts of these policies on biodiversity (TEEB, 2010, TEEB, 2011).

Moreover, the scientific literature on ecosystem resilience has shown that when **critical thresholds** are reached and a regime shift in an ecosystem occurs, its capacity to provide services can change drastically and in a non-linear way (TEEB, 2010). Ideally, ecosystem service indicators should allow us to anticipate proximity to such tipping points and function as an early-warning system to alert policy-makers, but few of the available indicators are able to do so (TEEB, 2010). It can be assumed that the wider the range of ecosystem services taken into consideration the more likely a reflection of future developments can be achieved. Studies (e.g., Hector & Bagchi, 2007) have shown that the relationship between ecosystem service provision and biodiversity is strongest where the delivery of a range of functions and services is taken into account.

As Anton et al (2010) underline, 'indicators for monitoring ecosystem services are an essential tool for communicating complex patterns and processes to decision-makers and measuring the success of conservation actions'. There is therefore a need, on one hand, to address current gaps through further development of ecosystem services indicators and, on the other, to better integrate the indicators developed by the scientific community into biodiversity policy-making.

In addition, different indicators may be necessary to distinguish between ecosystem services and the final **benefits** such services provide to their users. For example, the contribution of forests to pollution control can be measured both in terms of the trees' atmospheric cleansing capacity expressed as the quantity of pollutants removed, or in terms of human health impacts linked to reduced pollution, expressed in disability adjusted life years. Indicators that directly reflect final benefits may be more useful for assessing policy effectiveness or comparing the relative merits of different policy options.

Figure 4.4: Health and well-being – Possible Green Infrastructure indicators for underlying services/functions and resulting benefits

Benefits Group	Green Infrastructure services/function	Quantitative Benefits	Monetary Benefits
Health and well-being	**Air quality** • Atmospheric cleansing capacity in tonnes of pollutants removed per hectare • Downward pollutant flux, calculated as the product of dry deposition velocity and pollutant concentration	• Total amount of pollutants removed and contribution to air quality targets	• Reduced mortality from reduced respiratory illnesses • Avoided cost of air pollution control measures
	Accessibility for exercise and amenity: • Reduced stress levels and improving mental health • Increased physical activities	• Human health impacts expressed in disability adjusted life years (DALY = years of life lost + years lived with disability)	• Health care savings from e.g. reduced obesity, cardiovascular diseases • Avoided indirect costs, such as earnings lost due to inability to work

	Noise regulation Natural sound absorption capacity	• Persons/year where defined threshold in dB is not exceeded due to natural sound absorbers	• Health care savings from e.g. reduced cardiovascular diseases

Source: IEEP et al (forthcoming, 2011)

The biodiversity policy-makers we consulted in the course of the project located the indicators they use under only four stages of the policy cycle: problem recognition, problem exploration, monitoring & reporting, evaluation & reporting. As noted during the workshop on the use of sustainability indicators held in Brussels in February 2011, the design of the SEBI indicators may be a reason for this bias, as the focus of SEBI is on state and pressure indicators, while response indicators are under-represented. There is, however, scope for further applying indicators in the intermediary stages of the policy cycle, to identify possible solutions and support impact assessment or cost-benefit analyses of different policy options. Integrating values of ecosystem services (whether qualitative, quantitative or monetary), for example, could help policy-makers compare and select among different options.

4.1.3 Successful examples of the use of indicators

In several Member States (e.g. Belgium, Czech Republic, France, Germany, Portugal, the United Kingdom), the development of national sets of biodiversity indicators has been aligned to the SEBI framework (SEBI Coordination Team, 2011). Some of these sets are now undergoing revision following the adoption of new targets at global, EU and national levels.

In France, the *Observatoire national de la biodiversité* (ONB) is currently undertaking a review of national biodiversity indicators in order to align them to the targets and measures set out in the recently adopted National Biodiversity Strategy 2011-2020. A preliminary list of 21 indicators was published in May 2011, comprising indicators that are already available and ones requiring further analysis (ONB, 2011). **New indicators** presented for consideration include: average shift in the range of a set of climate-sensitive species *('déplacement moyen des aires de repartition d'un panel d'espèces sensibles au climat')*, the qualitative completeness of the protected areas network, percentage of threatened species subject to a national action plan, percentage of the national territory covered by a Territorial Cohesion Scheme (*Schéma de coherence territoriale*, SCoT) including biodiversity aspects, progress in the establishment of an Inter-governmental Platform on Biodiversity and Ecosystem Services (IpBES), percentage of the population listing plant and animal conservation among the top two environmental priorities, etc. According to the document, the ONB will also explore the possibility of adopting new indicators corresponding to other themes of the National Biodiversity Strategy, including: the overall impact of French society on national and global biodiversity, changing consumer behaviour, ecosystem services, the link between business, economic activities and biodiversity, biodiversity-related development aid, the conservation status of specific taxonomic groups, marine biodiversity, invasive alien

species, genetic resources including access and benefit sharing, the integration of biodiversity in education and training (ONB, 2011).

An example for the successful **integration of biodiversity indicators** into other policy areas includes their application in the context of a common Strategic Environment Assessment (SEA) monitoring system developed in Austria, to assess the impact of projects supported by Structural Funds on the environment (EEA, 2009). Common SEA guidelines (SUP-Leitfaden) are applied to collect data related to regional Operational Plans. These guidelines consist of a detailed checklist sub-divided into six environmental categories: biodiversity and landscape, cultural heritage, soil, water, air, climate, efficient use of energy and resources, and mobility. Identified interests of biodiversity 'safeguard' include species protection, and conservation of habitat functions and connectivity. As regards the provision of ecosystem services recreation and cultural heritage are mentioned. Related indicators amongst others include the application of species red lists, the extent of the Natura 2000 network, and area of protective forests (Bann-und Schutzwaelder).

Several countries are taking forward the development and application of **ecosystem services indicators**. For example, the Swiss Federal Office for the Environment (FOEN) has commissioned a feasibility study on the application of the 'final ecosystem services' (FES) approach developed by Boyd and Banzhaf (2007) to Switzerland's national income accounting and natural resources policy. FES are defined as end products and components of nature that are directly enjoyable, consumable or usable to yield human well-being (TEEB, 2011). FES indicators have the potential to supplement existing indicators to provide a more comprehensive measurement of welfare (Ott and Staub, 2009). While the environmental national accounts and the indicators currently used by FOEN focus largely on the pressure exerted by the economy on the environment, FES indicators focus on the direct link between environmental services and welfare (Ott and Staub, 2009). The study finds the approach useful in problem recognition, the identification and prioritisation of potential problem areas, the setting of strategic goals on the political agenda, and monitoring. Complementary approaches would still have to be used for problem analysis and the development and implementation of measures (Ott and Staub, 2009). A first inventory of 23 nationally-relevant FES and proposed indicators for each was released in early 2011 (Staub et al, 2011).

The UK National Ecosystem Assessment (2011) provides a good example of the application of ecosystem services indicators to evaluate the state and value of the natural environment and the effect of different policy scenarios. The report aims to provide an evidence base to support future policy and decision-making at various scales. The NEA's **conceptual framework** is structured around the processes linking human well-being to the environment. Indicators are used to describe state and trends (e.g. water quality), the drivers of change (e.g. fertiliser application rates), their consequences on well-being (e.g. health risks, increased water treatment costs) and management options (e.g. effect of agri-environment schemes). Indicators are also central to the scenarios developed in the NEA in order to project the impact that changes in drivers have on the output of a range of ecosystem services. Six policy scenarios are built around variations in five socio-economic variables – environmental awareness, human well-being (standards of health provision, education,

employment, freedom, etc.), governance and intervention (how much the state uses political authority and institutional resources to manage society), overseas ecological footprint, climate change adaptation capacity – and the implications of each scenario to ecosystem service delivery are examined. The NEA will form an important basis of UK's commitment[30] to develop a wider set of indicators to measure progress on its natural environment, the development of national accounts that take natural capital into consideration, the commitment to SEEA and the development of a Natural Capital Committee.

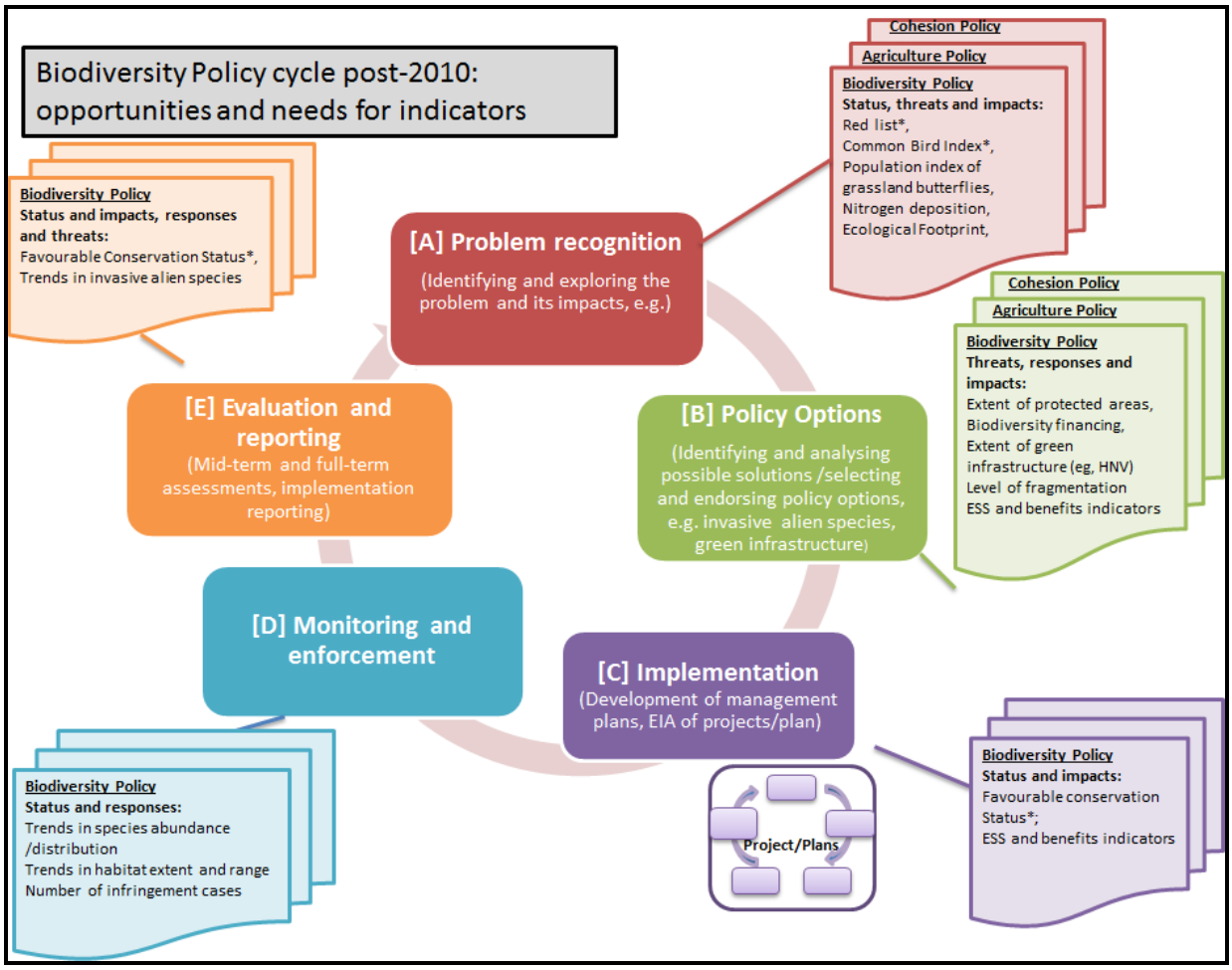
Several countries have developed national composite indicators that provide an aggregate measure of biodiversity. For example, the Netherlands has developed the N**atural Capital Index** (NCI), defined as the product of the size of the remaining area of an ecosystem (ecosystem quantity) and its quality. Ecosystem quality is defined as the ratio between the current state and a baseline state, both expressed in terms of the average abundance of a core set of species specific to the ecosystem. Variables related to ecosystem processes and structure can also be included in the measurement of quality. The NCI is applicable to multiple spatial scales and can be used in modelling and impact assessments within policy scenarios (ten Brink and Tekelenburg, 2002). Similarly, the Norwegian government initiated the development of the Nature Index framework (Nybø and Certain, 2011; Certain and Skarpaas, 2010), a monitoring and management tool that aims to synthesize existing knowledge on the state of biodiversity from various sources and communicate trends to guide policy makers. The NI is composed of a series of indicators, each representing individual species or diversity measures. The indicators are standardized and scaled in relation to a reference state considered ecologically-sustainable, and combined for ecosystems or geographical regions, to give a number between one (reference state) and zero (degraded biodiversity) (Nybø and Certain, 2011).

4.1.4 Future opportunities

As outlined above, biodiversity and ecosystem service indicators can potentially support policy-makers at different phases of the policy cycle, although currently existing sets strongly focus on its monitoring and reporting stages. There thus exists the need to look into where opportunities for which kind of indicators exist. This does not only apply for the EU biodiversity policy cycle, but also other policy areas where there is need and opportunity of further integrating biodiversity by the application of an appropriate set of indicators (e.g. cohesion policy). The figure below highlights at what individual stages these opportunities and needs exist, including an exemplary set of indicators. By featuring a range of policy folders the figure also aims to illustrate the necessity of developing a streamlined set of biodiversity indicators to be integrated into other policy areas (e.g. agriculture, cohesion policy, fisheries etc.).

[30] UK NEWP – Natural Environment White Paper on The Natural Choice: securing the value of nature. CM 8082 http://www.official-documents.gov.uk/document/cm80/8082/8082.pdf

Figure 4.5: Indicators along the EU Biodiversity Policy cycle



The **problem and recognition stage** of the cycle is focused on identifying and exploring the problem (e.g. habitat fragmentation and loss) and its impact (e.g. threatened species), and as such status, threats and impact indicators seem most suitable to inform this phase of policy development, including IN-STREAM indicators such as the Common Bird Index or Red Lists. The problem recognition is followed by the identification and analysis of possible solutions and the endorsement of **policy options**. Key aspect is the assessment of the environmental, social and economic impact of suggested initiatives (e.g. Green Infrastructure), in which impact indicators will have a crucial role to play. This particularly applies for ecosystem services and benefits indicator which allow addressing all three dimensions of sustainability. However, high importance also needs to be given to the application of appropriate response indicators, in order to get an understanding to what extent existing instruments have worked (e.g. extent of protected areas, early warning system on invasive alien species) and whether sufficient means of implementation are available (e.g. biodiversity financing). The **implementation phase** strongly links to the realisation of projects and related cycles, particularly in other EU policy areas (e.g. cohesion policy), but also when generally assessing the impact of plans and projects on the objectives

set out by EU biodiversity policy (e.g. Environmental Impact Assessment - EIA). However, practical experience revealed that biodiversity issues, especially relating to fragmentation and cumulative impacts, are often inadequately dealt with and there are often insufficient links to planning cycles (COWI 2009). The EIA-Directive[31] is currently under revision. A key objective is to improve the integration of biodiversity issues in the relevant stages of the EIA process, in addition to improving procedural provisions. This opens the opportunity to further analyse which status and impact indicators, including on ecosystem services and benefits, might be important key players. As outlined in the previous section existing sets of biodiversity indicators have been particularly applied in the **monitoring and reporting** stages of policy development, with particular emphasis on status and threats. Following the mid-term and full-term assessment of the EU Biodiversity Action, the European Commission recognised that good progress had been made in improving the biodiversity knowledge base, but also that monitoring and reporting will need to be further improved, by developing an integrated monitoring, assessment and reporting framework for the EU Biodiversity Strategy and CBD Strategic Plan. Such a framework should ideally require a certain level of standardised reporting on actions taken, to facilitate the development of at least qualitative indicators of response (e.g. scoring of standardised formulations), and to be distributed via a common information tool such as the Biodiversity Information System for Europe (BISE)[32].

Ecosystem services indicators in particular are needed to inform policy-makers of the economic, social and environmental consequences of different policy or planning options affecting biodiversity (TEEB, 2010). However, such indicators are a relatively new tool, currently available for only a fraction of the wide array of services derived from ecosystems. Further refinement and development of robust ecosystem services indicators is therefore needed. Biodiversity policy and other relevant policy areas should be underpinned by a **basket of indicators** that capture the multifaceted nature of biodiversity, to avoid **bias** towards species, habitats and ecosystem services for which data is most readily available. As underscored by TEEB, '*reliance on existing measures will in all likelihood capture the value of only a few species and ecosystems relevant to food and fibre production and will miss out the role of biodiversity and ecosystems in supporting the full range of benefits, as well as their resilience into the future*' (TEEB, 2010).

The **new policy developments** foreseen by the new EU biodiversity strategy call for new indicators and more systematic application of existing ones, especially with regard to ecosystem services. For example, the development of a Green Infrastructure strategy by 2012 will require indicators in the problem recognition/exploration phase (e.g. loss of ecosystem services due to habitat fragmentation), the identification of possible solutions (e.g. the relative efficiency of different Green Infrastructure elements in delivering ecosystem

[31] Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment

[32] http://biodiversity.europa.eu/

services), analysis of policy options (e.g. efficiency of different policy instruments in achieving the set targets), the implementation process in Member States (e.g. expected benefits of different Green Infrastructure projects/measures to help prioritise investments), ongoing monitoring and evaluation (e.g. changes in the status of species and habitats due to the policy's implementation, avoided loss of ecosystem services). Similarly, the foreseen no-net-loss initiative (through instruments such as compensation and offsetting schemes) will require ecosystem services indicators, for example, to assess comparability between ecosystems, potential trade-offs in the provision of services, to identify the beneficiaries and suppliers of ecosystem services, etc. As already emphasised the growing focus on ecosystem services and the economic value of biodiversity can mark a closer integration of biodiversity into the social and economic dimensions of sustainability. Natural capital and ecosystem services figure prominently in the new roadmap to a **resource efficient Europe**[33], presented as one of the seven flagship initiatives of the Europe 2020 Strategy. Proposed milestones refer to the no-net loss initiative and Green Infrastructure. However, biodiversity itself appears to be only a 'supporting act', and only a provisional lead indicator on resource productivity and complementary indicators on identified key natural resources such as water, land, materials and carbon have been proposed.

A new Regulation on European environmental economic accounts[34] adopted in July 2011 makes the submission of national environmental accounts to the European Commission a mandatory requirement (see Chapter 2.2). The Regulation aims to aid the collation and comparability of data that is at present collected by Member States on a voluntary basis and based on the United Nation's system of integrated environmental and economic accounting (SEEA). The environmental economic accounts to be compiled shall be grouped into three modules: air emissions accounts, environmentally related taxes by economic activity, economy-wide material flow accounts. The Regulation outlines a range of additional modules that the Commission may propose to introduce at a later stage, including **Ecosystem Services Accounts**. The reporting process associated with the Regulation presents an opportunity for the development of new indicators and their application to policy-making. Data reported under the regulation will form part of the European environmental economic accounts and will constitute a key input to impact assessment, action plans, legislative proposals and other significant steps of Member State and EU policy-making.

4.1.5 Policy recommendations

The following key recommendations can be summarised from the analysis in the previous sections, including some immediate opportunities for a better use of biodiversity indicators and major gaps that require additional research/analysis:

[33] Communication on a Roadmap to a Resource Efficient Europe COM(2011) 571

[34] Regulation (EU) No 691/2011 of the European Parliament and of the Council of 6 July 2011 on European environmental economic accounts

- Develop streamlined set of indicators for different policy areas (integrated set of indicators). 'Land use' can form an important frame for developing such sets.

- Endorse the further use of widely applied IN-STREAM indicators such as on Favourable Conservation Status in other policy areas (e.g. agriculture policy, cohesion policy), by also guaranteeing their continuous, frequent and timely update and general robustness of methods.

- Develop set of indicators most suitable to inform the roadmap to a resource-efficient Europe and in the end the Europe 2020 Strategy

- Explore the development of response indicators, in the short-term from existing databases and reporting cycles (e.g. EU Biodiversity Action Plan), and in the long-term by standardised reporting which facilitates the development of qualitative indicators of response.

- Further develop ecosystem services indicators, separating the physical basis and outputs for human well-being;

- Apply a wider range of ecosystem services indicators to guarantee strong linkage to biodiversity and as proxy basket to capture resilience of ecosystem services provision.

- Further analyse the development of Ecosystem Services Accounts as part of European environmental economic accounts, building on existing initiatives.

4.2 Agricultural policy

4.2.1 Key policies where indicators have a role to play

Utilisation of agricultural land for food, fibre and energy production in Europe influences the environment considerably. The magnitude of overall environmental impacts through agriculture varies from country to country and reflects partly varying importance of agricultural land use across different Member States. From the viewpoint of environmental sustainability, the management practices associated with these land uses can have both positive and negative impacts on the environment and natural resources.

Major concerns have been expressed about the status of most species and habitats associated with agricultural land, about the use of scarce water resources, soil management, and the continuing problems of diffuse water pollution by nitrate and pesticide run-off (Cooper et al., 2010; EEA, 2009a; EEA, 2009b; JRC, 2009; OECD, 2010). Some improvements have been noted in air quality, reductions in greenhouse gas emissions from agriculture, and the slowing down of trends in nitrate pollution in certain Member States. However, a lot remains to be done in agriculture to reduce pressures on the environment, and in particular to meet the European targets on climate change and biodiversity.

The Common Agricultural Policy (CAP) has been a central element of European policy since the Treaty of Rome in 1957. The original focus was on supporting agriculture to provide stable food supplies, and this was achieved by a range of market measures including import tariffs, export subsidies, intervention purchasing, private storage aid, quotas and direct payments to farmers. Combined with far-reaching technological advances, the CAP was hugely successful in increasing agricultural production, which in turn led to problems of over production, increasing costs, incompatibility with international trade rules and concerns over environmental impacts. To deal with these problems the CAP has been subjected to several major reforms and an almost continuous process of adjustment, for the past 50 years, but despite this the objectives as stated in the Treaty have remained unchanged, and make no reference to environmental policy.

The basic structure of the CAP today, which is likely to remain in place until at least 2013, is often characterised as two ‘Pillars’, with around three quarters of the budget in Pillar 1 where it is mainly used for direct payments to farmers. The remainder of the budget forms the European Agricultural Fund for Rural Development (EAFRD) to fund Pillar 2, used by Member States to support seven-year rural development programmes.

Until the 1980s the pressures on the environment were not widely acknowledged in agricultural policy, and the indicators through which the agricultural sector understood its role and presented its efforts to the broader public tended to focus on productivity, farm incomes and agricultural structures. This introduction of the concept of environmental sustainability into the CAP over the past 25 years has been accompanied both by new uses of other types of traditional indicators and, more recently, by new indicators.

Familiar indicators, such as the total area of different types of agricultural land use, or changes in land cover, which had been long used to identify bio-physical assets in national accounts, were increasingly investigated using spatial linkages between land use characteristics and known causes of environmental damage. For example, the land use indicator demonstrating that 44 per cent of the land area of the EU-27 is associated with agriculture, 62 per cent of this area is under arable and cereal crops, 31 per cent under pastures, and 6 per cent under permanent crops (Eurostat, 2009), became more environmentally meaningful only when combined with additional qualitative and semi-quantitative information about the impacts of specific farmland management on natural resources such as water and biodiversity. Such information has been gradually accumulated since 1980s with respect to two major trends in agriculture that drove environmental deterioration, i.e. marginalisation/abandonment and intensification/concentration of production. The main remaining challenge was to develop more nuanced indicators capable of capturing at policy level the direct causal links. Such indicators were needed to distinguish between, first, the policy incentive and a change in land management practice and second, between the change in land management practice and the observed impact – positive or negative, on the actual environment (Schuh et al., 2010).

These indicators demonstrated usefully, if somewhat crudely, both the negative impacts of some farming systems and the benefits of extensive land uses for biodiversity, water, soil and landscapes, and were supported by specific research that highlighted some of the environmentally beneficial management practices specific to particular combinations of land use, soils and climates. This led to the development of two broad types of policy tools to promote sustainable trends in agriculture and link the CAP to the EU environmental agenda. The value of the beneficial practices (and the need to maintain them) was acknowledged in the 1992 McSharry reforms of the CAP, which for the first time committed EU policy and CAP funds to making multi-annual agri-environment management contracts available to farmers across the whole of the EU territory, encouraging environmental management practice going beyond the legal baseline. These incentive payments for the provision of specific environmental services from farmland became a major component of Pillar 2 of the CAP and remain the only rural development measure that all Member States must implement.

These beneficial management practices are contrasted with the land management that prioritises efficiency of food production and productivity, and may not be free from causing environmental damage. The approach to mitigate these under the CAP Pillar 1 was to place environmental conditions, otherwise known as ‘cross-compliance’, upon the receipt of farm income support payments from Pillar 1, Introduced in 2003, cross-compliance sets a regulatory baseline which includes all the pre-existing environmental standards applicable to agricultural land at farm level (e.g. elements of the Birds, Habitats, Nitrates and Water Framework Directives))plus the additional land management standards for the ‘good agricultural and environmental condition’.

This reform agenda did not seek in the first place to institute a coherent measurement system to quantify the positive and the negative environmental impacts of agriculture, nor did it attempt to link these impacts to the new environmental policies in either Pillar of the CAP. When improved measurement system was gradually introduced, its use also diverged, with indicators linked explicitly only to the Pillar 2 rural development policies, rather than to the cross-compliance under Pillar 1.

Since its origin in the 1980s the agri-environment measure has become a long-standing and by now an accomplished example of a scheme for the payment for ecosystem services which promotes conservation of natural resources in agriculture in the context of global markets. Using a combination of CAP and national/regional co-financing the measure encourages farmers and land managers to manage their land to provide ecological services going beyond the baseline and appropriate for the locality, for water, soil, biodiversity and landscapes. When the agri-environment was to become in 2000 one of the important components of the new rural development policy pursuing sustainability goals and governed by a programming approach under the so-called Pillar 2 of the CAP, the scope and role of indicators in quantifying the actual environmental outcomes of the measure as well as the whole rural development policy increased.

In contrast environmental indicators were neither driving nor underpinning the 2003 changes in Pillar 1 support mechanisms for farmers' incomes, although these were some of the most significant changes to agricultural policy at EU level since the Treaties of Rome. The 2003 changes were driven by a combination of factors, including EU enlargement, international trade negotiations and the distorting effects of income support payments on commodity production. The introduction of compulsory 'cross-compliance' as part of these Pillar 1 reforms, based on a common framework for environmental sustainability standards in the EU agriculture, was a response to a widely spread recognition at the time that it was production-linked support under the CAP that was driving the use of some environmentally damaging management practices with deleterious effects on water quality, biodiversity and cultural landscapes. However, to understand why this reform was not underpinned by a system of monitoring and evaluation based on indicators, the market drivers of the policy reform need to be considered. There were incidental environmental effects of removing the link between payments and production and constraining agricultural production (through the continuation of milk quota and set-aside) but these were not the main drivers, although they were generally perceived as beneficial (at least in the short term).

Despite the lack of policy specific indicators for Pillar 1 policies (which still account for the majority of the CAP payments to farmers), attempts have been made over many years to record in regional and national environmental accounts the environmental impacts of agricultural land use associated with agricultural policy. The Common Bird Index (one of the core IN-STREAM indicators for this project) is a good example of an indicator that has been used quite systematically from before the 1970s in some Member States (e.g. the UK and Germany) and was considered to be a good proxy for the health of farmland biodiversity in the absence of other information. It was not until 2005, when a more comprehensive monitoring system was introduced for the CAP rural development measures in Pillar 2 (see

below), that the Common Bird Index was incorporated into EU policy in a more rigorous way. It has been noted that none of the indicators for environmental sustainability has yet managed to be as influential in rural development policy as the structural socio-economic indicators such as GDP and gross added value, but if one can be highlighted as having come close, it is the Common Bird Index. This achievement highlights a certain limitation in compiling accounts focusing on only one type of biodiversity, while leaving out other taxa, e.g. invertebrates and plants. . Other important and influential indicators used to monitor impacts of agricultural land use since the 1990s, which are not part of the IN-STREAM set, are gross nutrient balance and gross nitrogen balance, both being introduced in national accounts partly as response to the EU environmental policy for regulating the nitrate pollution from agriculture.

As other indicator exercises were being launched in the EU and world-wide (e.g. to measure the impacts of EU Cohesion policy, the Sustainable Development Strategy and the Convention of Biodiversity) and the OECD introduced its own set of agri-environment indicators in 2001 (OECD, 2001), the EU launched its IRENA operation (Indicator Reporting on the Integration of Environmental Concerns into Agriculture Policy). This was based on a suite of agri-environment indicators intended to be used to measure environmental impacts of agricultural policy generally (not just the agri-environment payments in Pillar 2), identify shortcomings of existing measures and the need for new policy initiatives and, where appropriate, to inform improvements to the targeting and tailoring of the measures. Following the development and the first evaluation of the IRENA indicators (EEA, 2005), the Commission published a Communication in 2006 in which it proposed the adoption and further development of a suite of 28 agri-environmental indicators designed to track impacts in four main areas, involving farm management practices, agricultural production systems, pressures and risks to the environment, and the state of natural resources.

More specifically to be incorporated in the rural development strand of the agricultural policy, including the agri-environment measure, environmental evaluation requirements were introduced under Pillar 2 of the CAP in 2000, and were strengthened and refined from 2007, when the Common Monitoring and Evaluation Framework (CMEF) was introduced. This is a more targeted and comprehensive policy evaluation system, with a range of indicators for economic, environmental and social sustainability, building on the experience of earlier indicator frameworks. Its goal is to assess the outcomes achieved through the use of specific CAP rural development measures and with that in view it includes a specific suite of indicators for environmental sustainability. The CMEF is a good foundation for the systematic monitoring of the environmental outputs and impacts of rural development measures across the EU-27 Member States, and hence is an important theme of this chapter.

In the context of the legislative proposals for the next CAP reform, due to be published in late 2011, it is useful to investigate both past and present initiatives using environmental indicators against the backdrop of the key policy priorities for EU agriculture in the future. These are set out in the 2010 Commission Communication ‘The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future EU2020 strategy’:

- Viable Food Production;
- Sustainable Management of Natural Resources and Climate;
- Balanced Territorial Development.

It is certain that a number of indicators analysed in the IN-STREAM project would in theory be useful to demonstrate the impacts of the agricultural land use in Europe and perhaps also of some elements of CAP policy (e.g. income support payments in Pillar 1) in relation to these future objectives. These indicators might include, for example, Adjusted Net Savings, the System of Integrated Environmental and Economic Accounting (SEEA-2003), resource indicators such as HANPP, GDP, GHG intensity, GDP Energy intensity, per capita waste generation and energy from waste, or Human Development Index). In practice, determining the contribution of the main CAP support instruments within Pillar 1 to environmental outcomes measurable by indicators continues to be challenging. This is because of the range of exogenous factors that play an important role in agricultural management, such as the prices of commodities and inputs, technological developments, market requirements, and environmental regulation, as well as the effects of climate change on farming systems, particularly as these differ from most other sub-systems of national economies in being situated at the interface between natural and man-made environment. In addition there are issues of data availability further discussed below.

It is clear from this analysis of the development and use of environmental indicators for the CAP that more information is available about the interaction between indicators and environmental impacts of rural development policy under the Pillar 2, in recent years in particular, than is available for Pillar 1, where the bulk of CAP expenditure lies. This research note looks more closely at the indicators that could be useful in particular with regard to the sustainable management of natural resources and climate, the second of the post-2013 policy objectives, and with a focus on rural development policy.

4.2.2 Use of sustainability indicators at present

This chapter is structured around two suites of indicators which are most frequently used and debated in the area of agricultural policy:

- Agri-environment indicators used for agricultural land use generally (with a focus on the IRENA exercise and its follow-up);
- CMEF indicators used specifically for the 2007-13 Rural Development Programmes funded by Pillar 2 of the CAP.

These suites of indicators have been developed for different purposes and launched at different periods. While the IRENA indicators are useful to describe the context for the environmental sustainability in the CAP more broadly, most of them are not integrated into the CAP as tools to measure the extent to which policy targets have been achieved. Their scope is designed to be much wider, aiming to address impacts of agriculture and

agricultural land use, which are shaped by a number of exogenous drivers (e.g. markets, commodity prices, trade issues, bioenergy policies, climate change, national and regional policies etc.) alongside agricultural policy itself. The CMEF indicators, on the other hand, have been designed to feed directly into Member State's programming efforts for the 2007-13 rural development policy, with reporting and monitoring mechanisms relating to economic, environmental, and social issues (Terres et al., 2010). The two suites of indicators are therefore discussed separately below.

Agri-environment indicators

The original suite of 35 agri-environment indicators identified in the 2005 IRENA exercise was intended to use the existing data sources and design measurements that could serve a variety of policy purposes. These were summarised as:

- to provide information on the current state and ongoing changes in the condition of the farmed environment;
- to track the impact of agriculture on the environment;
- to assess the impact of agricultural and environmental policies on the environmental management of farms;
- to inform agricultural and environmental policy decisions; and
- to illustrate agri-environmental relationships to the broader public.

The process of developing the IRENA indicators (launched at 2002 with a geographic focus limited to EU-15 at the time) was a policy response to the 1998 Cardiff and Vienna European Councils which stressed the need to assess the impact of various economic sectors (including agriculture) on the environment, and referred to the role of appropriate indicators in such assessments. It is important to understand that the term 'agri-environment indicator' in the IRENA process is therefore used in a much more general way than in agri-environment policy under Pillar 2 of the CAP. The IRENA agri-environment indicators mean to capture both the positive and negative influences of agricultural production systems (as complex economic entities) on different environmental resources in the context of diverse environmental and agronomic conditions. The process encouraged stakeholders and Member States to develop concepts, identify data sources and compile relevant data sets. In the 2005 evaluation it transpired that the process had indeed generated a substantial amount of knowledge on how feasible the operation and interpretation of certain indicators were. It had also prompted the gathering of a substantial amount of data on the state of and trends in environmental conditions relating to agriculture, and on the measures available to deliver environmental integration (EEA, 2005).

In the context of the IN-STREAM project, with a particular focus on understanding the role that indicators can play in the policy cycle of a selected number of EU policy areas, the IRENA indicators are a good example of a useful initiative aimed at a deeper understanding of measuring the environmental outcomes of agriculture and agricultural land use. At the same time a number of questions need to be tackled, if we are to be able to appreciate the usefulness of these indicators for evaluating the environmental performance of policies

under the CAP specifically. This is because the actual relationship of this suite of indicators to the policies or policy cycles under Pillar 1 and Pillar 2 of the CAP is not entirely straightforward. While the 2006 IRENA evaluation prompted another phase of work on refining the agri-environmental indicators into a set of feasible measurement tools, the applicability of these indicators to reporting and monitoring mechanisms within the CAP policy measures has certain limits. Causality and a clear link with policy incentives may be too difficult to establish; site specific circumstances such as rainfall patterns and climate factors may need to be taken into account; and measurable environmental impacts may take a long time to emerge and may be interlinked with impacts of a number of other policies and other exogenous factors. Those IRENA indicators that have been selected for the CMEF evaluation framework were the indicators for which the causal linkages to individual policy measures were fairly clear, and operational models and data were available at appropriate territorial level, and thus could be used in determining the policy outcomes. Examples are the following (Terres et al., 2010):

- High Nature Value Farmland areas (biodiversity);
- Risk of soil erosion;
- Production of renewable energy;
- Farmers' qualifications (training and education);
- Marginalisation; and
- Specialisation/diversification.

Under the 2006 initiative developed out of the IRENA process, a suite of 28 agri-environment indicators have been identified and proposed for streamlining in the policy measures. The Common Bird Index (analysed within the IN-STREAM exercise), together with a few other fully operational indicators, such as intensification/extensification of agriculture, ammonia emissions, and greenhouse gas emissions, have become useful tools for communicating certain environmental impacts of agriculture to the public. The new initiative pointed at remaining weaknesses, and deficiencies in the data sets related to the measurement of certain indicators. These include, for example, issues concerning the harmonisation of national statistics (e.g. relating to farm management practices), of data quality (e.g. genetic diversity), some issues of data availability (e.g. water usage for agriculture; area under irrigation; sustainability of irrigation practices); issues of data availability specific to new Member States (e.g. data on water quality data with a sufficient geographic coverage; time series data for organic farming); and gaps (landscapes, abandonment, etc.) (EC, 2006a; Terres, 2010; Piorr, 2010; Barankova, 2010). For other indicators, such as those relating to soils or landscape, the main shortcoming is that the models underpinning them are not yet methodologically mature, and will need substantial testing and investment before rolling them out within a monitoring systems across the EU (e.g. soil erosion) (EC, 2006a; Terres, 2010). Lots of conceptual improvements have been made to certain indicators, for example those for high nature value farmland areas and farm management, and some conceptual work remains to be done to improve data availability at appropriate territorial level (Piorr, 2010; Pepiette, 2011).

Common Monitoring and Evaluation Framework Indicators

The current Pillar 2 programming period saw formalisation in the CAP rural development policy of a more sophisticated version of the previous reporting and evaluating requirements. Introduced as the Common Monitoring and Evaluation Framework (CMEF), this suite of requirements created the basis for the systematic monitoring of the inputs, outputs and impacts of rural development measures across the EU-27 Member States. CMEF indicators are designed to measure outcomes for all three sustainability objectives of Rural Development Policy:

- 'objective 1': improving the competitiveness of the agricultural and forestry sector;
- 'objective 2': improving the environment and the countryside;
- 'objective 3': the quality of life in rural areas and diversification of the rural economy.

The CMEF suite of indicators addresses all the sustainability objectives and is therefore complementary to the key sustainability indicators assessed in other parts of this IN-STREAM deliverable, while at the same time being more specifically related to assessing the impacts of funding through the CAP rural development policy.

Table 4.1 Selected CMEF indicators with potential for the environment

CMEF indicators categories	Indicator
Baseline indicators – objective related	
Biodiversity: Population of farmland birds Environment	Trends of index of population of farmland birds
Biodiversity: High Nature Value farmland	UAA of High Nature Value Farmland
Biodiversity: Tree species composition	Distribution of species group by area of FOWL (%coniferous/% broadleaved/%mixed)
Water quality: Gross Nutrient Balances	Surplus of nitrogen in kg/ha Surplus of phosphorus in kg/ha
Water quality: Pollution by nitrates and pesticides	Annual trends in the concentrations of nitrate in ground and surface waters Annual trends in the concentrations of pesticides in ground and surface waters
Soil: Areas at risk of soil erosion	Areas at risk of soil erosion (T/ha/year
Soil: Organic farming	UAA under organic farming
Climate change: Production of renewable energy from agriculture and forestry	Production of renewable energy from agriculture (ktoe) Production of renewable energy from forestry (ktoe)
Climate change: UAA devoted to renewable energy	UAA devoted to energy and biomass crops
Climate change/air quality: gas emissions from agriculture	Emissions of greenhouse gases and ammonia from agriculture

Output indicators (an example for one measure)	
Output indicator for agri-environment payments	Number of farm holdings receiving support Total area under agri-environmental support Physical area under agri-environmental support under the measure Total number of contracts Number of actions related to genetic resources
Result indicators	
Area under successful land management	Area under successful land management contributing to: a) biodiversity and high nature value farming/forestry b) water quality c) mitigating climate change d) soil quality e) avoidance of marginalisation and land abandonment
Impact Indicators	
Reversing Biodiversity decline	Change in trend in biodiversity decline as measured by farmland bird species population
Maintenance of high nature value farmland and forestry	Changes in high nature value farmland and forestry
Improvement in water quality	Changes in gross nutrient balance
Contribution to combating climate change	Increase in production of renewable energy.

Source: European Commission, 2006b

The legal basis for the CMEF suite of indicators was set out in the implementing rules for the Rural Development Regulation. These specify requirements for Member States to report annually on the implementation of the programme in relation to the objectives and targets set on the basis of the CMEF output and result indicators. Ex-ante evaluation, mid-term evaluation and an ex-post evaluation of the programmes are required. Ex-ante evaluation is expected to identify and appraise the medium- and long-term needs, the goals to be achieved, the results expected, the quantified targets in relation to the anticipated impact in relation to the baseline situation, the Community value-added, the extent to which the Community's priorities have been taken into account, the lessons drawn from previous programming and the quality of local procedures for implementation, monitoring, evaluation and financial management.

The Common Bird Index, included in the quality analysis of the IN-STREAM exercise, was incorporated in the programming stage of the policy cycle at EU level, as part of the CMEF system both at the level of Baseline Indicators and Programme Impact Indicators. This means that the baseline and target value of indicators have to be specified in the programme documents developed at national and regional levels, and be monitored and reported throughout the cycle, in particular in mid-term and ex-post evaluations. This data series has become an important source of information about the health of farmland habitats. However, due to the time lag between the policy implementation and the observable outcome in bird species populations it would be unrealistic to seek outcomes at individual project level or

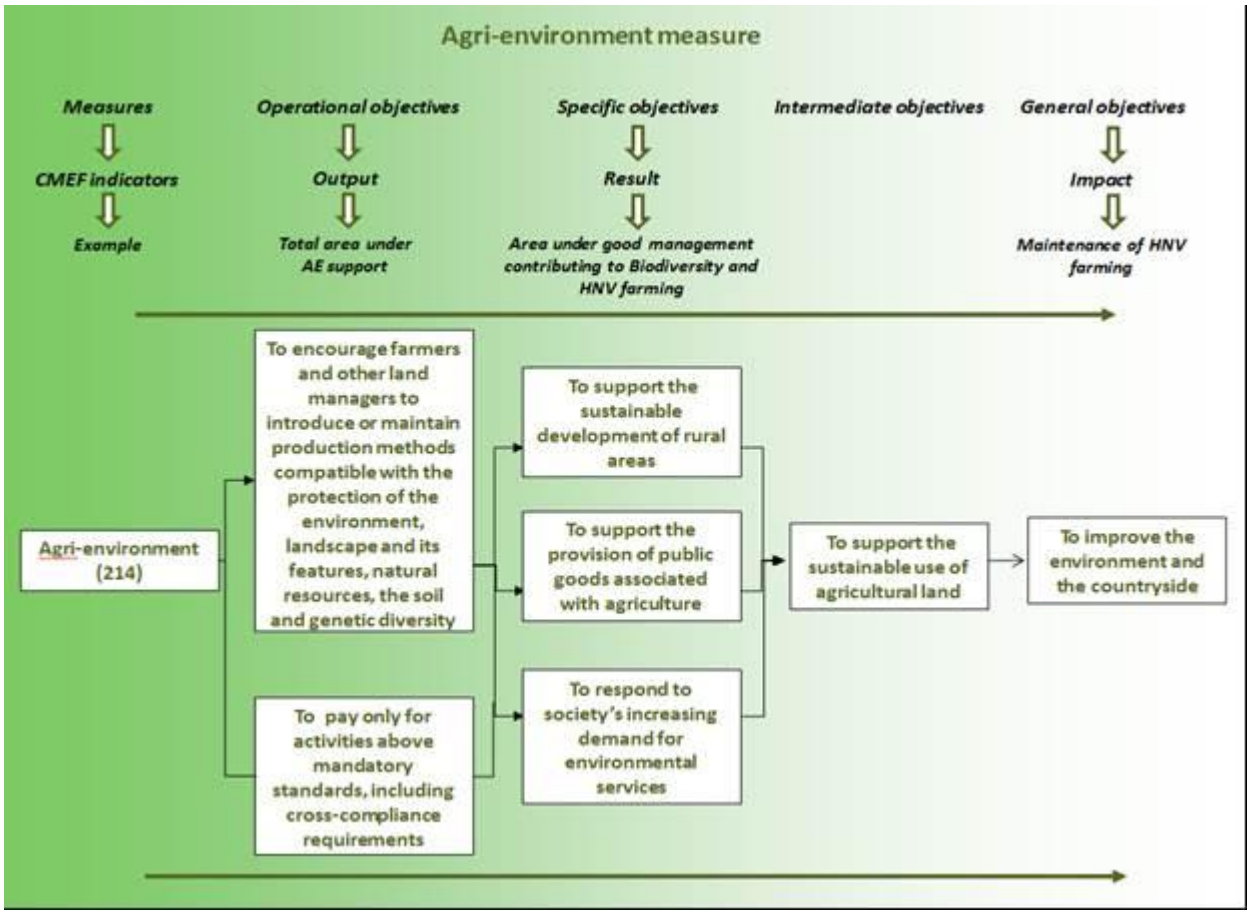
over any shorter time period. However, the fact that the bird indicator has been communicated to the wider public as a proxy for biodiversity impact of rural development measures means that it has indirectly encouraged a number of locally important participatory efforts to combine certain environmental awareness raising activities such as bird watching with other sustainability options, e.g. agro-tourism, and the marketing of value-added products from farming systems in the protected areas (e.g. Mantino, 2006).

Although not analysed in the IN-STREAM project as indicators of ecosystem services, certain CMEF Baseline Indicators, such as those for soil erosion and water pollution, (e.g. gross nutrient balance) are good examples of measuring the ecosystem services expected to be delivered by the environmental land management measures in the RDPs. It has been observed that, for example, in the Baltic countries the introduction of the CMEF reporting requirements on the indicators for gross nutrient balance, in conjunction with the introduction of cross-compliance obligations to reinforce sound manure management linked with the Nitrate Action Programmes, significantly raised environmental awareness among farming populations and stakeholders about the deleterious impacts of more productive market-driven farming systems[35]. In turn this encouraged important efforts to improve the farming practices and manure storage facilities to avoid aggravation of the water pollution trends. It has been also noted that there is additional scope in the CMEF indicator suite for covering other ecosystem services, in particular in relation to other important soil characteristics, e.g. soil carbon and soil organic matter, and in relation to a more coherent GHG reporting.

The CMEF system is based on the so called ‘intervention logic’ which links causally the budgetary input via the outputs and results of the specific measures to their impact. It sets out a hierarchy of objectives to be formulated in the programme, and matches them with a hierarchy of indicators, as illustrated in the figure below.

[35] Schuh, pers.comm

Figure 4.6 Example of linkages between hierarchy of objectives and hierarchy of indicators, elaborates for the measure for Agri-Environment payments (214)



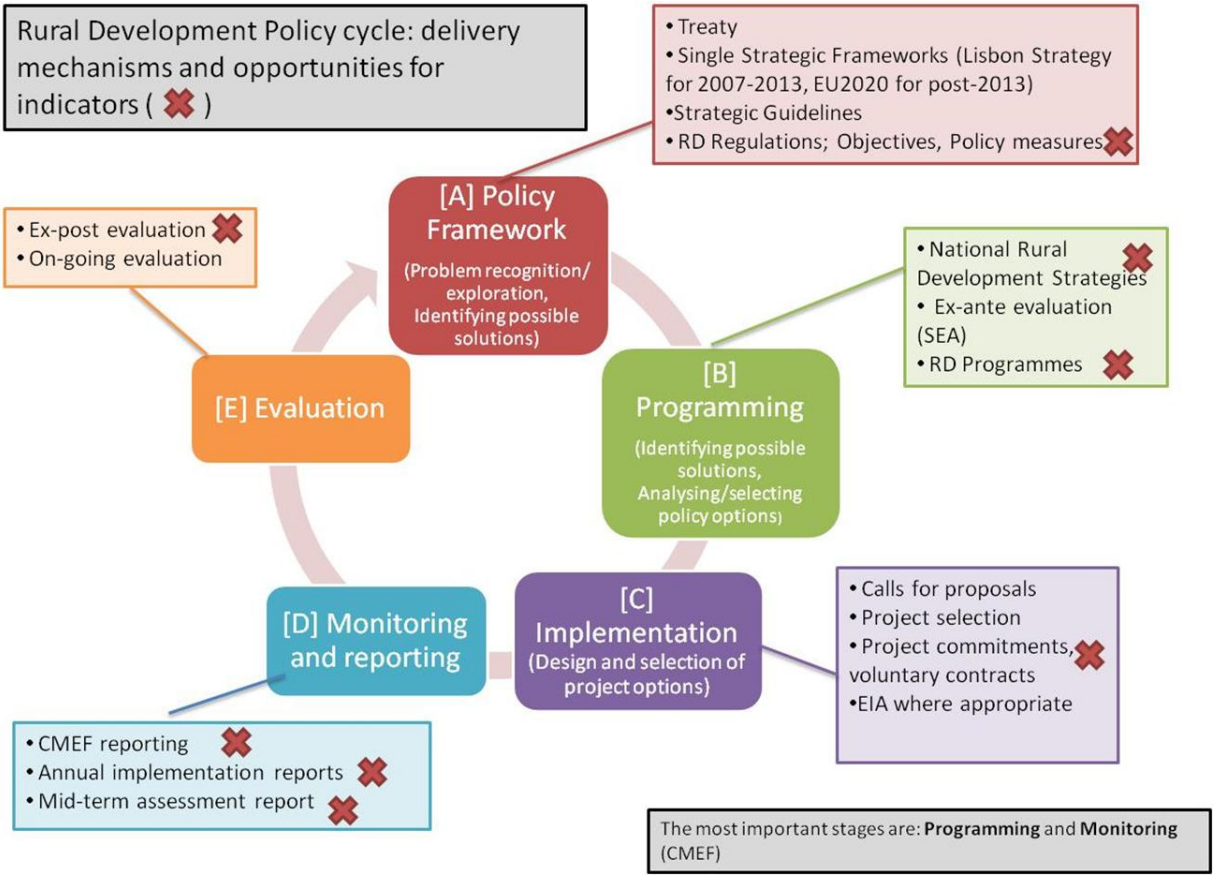
Source: adapted from Cooper et al (2009)

The points in the whole policy cycle where the CMEF indicators intervene are illustrated Figure 1.2. The present suite of the CMEF indicators were defined in the programming stage during the preparation of the 2007-2013 period of rural development policy, corresponding with its general and intermediate objectives, and in relation to the operational objectives of specific measures. These objectives were set out in the EU strategic, programming and implementation documents in response to problems identified through the evaluations of the previous programming period and a more general indication of problems in sustainable land management addressed through environmental policies, for example the Nitrates Directive, Water Framework Directive or Soil Thematic Strategy. The national authorities define at the programming stage the baseline indicators to describe the general circumstances, such as socio-economic situation and current state of the environment, including initial state of the parameters of economic, environmental and social sustainability that the programme intends to change. Furthermore, the Member States propose the output indicators for each individual measure they include in the programming documents, the result indicators for the whole area of environmental sustainability, and the impact indicators through which they quantify anticipated achievements of the whole national/regional programmes. All these indicators, except for the baseline ones which do not change, are used by the Member States in ex-

ante evaluation, in annual reporting, mid-term and ex-post evaluations. This way of structuring, monitoring and evaluating the cycle differs partly from the previous programming period where annual reporting and evaluation was required but the suite of indicators to be used was not defined in any prescriptive way, except for a rather vague requirement that 'physical and financial indicators were agreed and established beforehand'. As the 2007-2013 programming period is the first experience with the full implementation of the new CMEF system, lessons will be drawn for informing future policy and some changes at programming level can be expected for the post-2013 period.

Two IN-STREAM indicators that have undergone qualitative analysis - Gross domestic product (GDP) and Common Bird Index - are incorporated in the CMEF system. Both are listed among the Baseline indicators and additionally, the Common Bird Index is used for quantifying one of the key Impact indicators, 'Reversing biodiversity decline'. With regard to Ecosystem indicators, the measurement of climate change mitigation, soil erosion, and water quality are currently addressed through several Baseline indicators, but the policymakers and researchers are aware of a number of remaining gaps in the area of soil and water availability in particular. Also the Result indicator 'area under successful land management' can be seen as addressing only a certain characteristic of attempts to deliver ecosystem services. However, it has been noted that physical area is a rather weak way of indicating the composite impact on ecosystems and a more robust composite indicator describing the health and vitality of ecosystems would be most welcome.

Figure 4.7 Example of use of indicators within the policy cycle of rural development



The iterative use of the CMEF indicators in the policy cycle, in the programming, monitoring and evaluation activities in particular, is critical for understanding the results and outputs of these specific measures, including the outcomes of the programmes for the environment. It helps determine the factors that have contributed to the relative success or failure in achieving the stated objectives, which is a pre-requisite for informing the sorts of improvements that are needed in terms of the design and targeting of support, and there is a wide agreement that it provides a good foundation for future work (Cooper et al., 2010; Hart, 2010; Schuh et al., 2010; Pepiette, 2011; Dwyer et al., 2008). One particular lesson drawn from our own screening of a number of mid-term evaluation reports is that some national evaluations provide rich quantitative and qualitative evidence, including imaginative methodological efforts and thorough evaluation research as background (e.g. in Austria) while others do not carry out the biodiversity assessments at all or give descriptive answers of uncertain quality.

For example, a number of evaluations present findings on the biodiversity benefits of agri-environment measures on the basis of a questionnaire survey which collected farmers' views without providing them with any stringent criteria and without attempting to interpret the results of the survey against the backdrop of scientific evidence. This reporting failure is to be noticed on two counts. Firstly it seems to confirm that some Member States keep having certain difficulty in recognising the importance of integrating biodiversity agenda in

agricultural policies on the ground and try to avoid mandatory reporting requirements (like Spain, some Italian regions and, partly, France).

Secondly it highlights a clear reluctance of some Member States (such as the Netherlands, Belgium-Flanders, Luxembourg, France, who undoubtedly have ample expertise and knowledge available to carry out biodiversity related evaluation) to dedicate necessary resources to the mandatory exercise at all.

Of interest also is our finding that the biodiversity related evaluations provided by the sample of new Member States may display data weaknesses, methodological issues and certain limits on resources invested as well, but they do give the basic ecological information required by evaluation guidelines, and do provide some useful insights on farmland biodiversity trends specifically relevant to agri-environment measures. From this it seems possible to infer that agricultural authorities in the new Member States respond reasonably well to coercive monitoring and reporting approaches on issues where they might have taken a less biodiversity oriented and less costly evaluation approach if they had the choice.

Key issues in the CMEF system remain with the assessment of environmental outcomes against the counterfactual scenario (i.e. what would have happened to the ecosystems in the area without the given rural development measure) which would probably yield, if available, much needed information about the tipping point of balance between the environmental sustainability and the economic and social pillars of sustainability in the absence of policy support for environmental measures under Pillar 2. For example, the agri-environment measure has been recognised as contributing to biodiversity, water and soil, as well as supporting incomes of farmers in some extensively farmed areas, and thus enabling continuation of beneficial land management. In the absence of such a measure, a number of scenarios can be imagined, which would favour competitiveness of farmers within wider local economies, e.g. through capital investments in tourist infrastructure, holiday homes, and local business, or might lead to abandonment. Whilst environmental deterioration is likely to take place in most of these alternative scenarios, such counterfactual information is hard to capture through quantitative indicators. It has been also found difficult to unravel the effects of the measure from effects of other intervening factors such as site/specific circumstances, e.g. rainfall, temperature, soil. There are also concerns are about the time period which elapses before a measure begins to bring the environmental benefit or show negative environmental effects, with availability and the robustness of data (Schuh et al., 2010).

Of other IN-STREAM indicators, the Favourable conservation status and Red list index have already played valuable roles nationally and at EU level to demonstrate the long-term deterioration of agricultural habitats, and in doing so have had certain influence on the objectives of the present rural development policy at the programming stage of the policy cycle. Their more rigorous incorporation within the CMEF system is not plausible, however, first of all because of environmentally important issues such as time lag between the policy implementation and the outcome for biodiversity on the ground, and secondly, because of the role of exogenous factors beyond the remit of agricultural policy discussed above. However, the influence of FCS and Red List index at the programming stage is likely to

remain and may perhaps increase in future. As the recently published EU Biodiversity strategy demonstrated they have underwritten the setting of the EU biodiversity targets within environmental policy with a specific target for agriculture, which can in turn be interiorised in the EU rural development policy. The actual result will depend to a large extent on the interplay between the present political processes at EU level involving the Biodiversity Strategy, the CAP and the EU Budget and on the interplay with other sustainability agendas such as competitiveness and resource flagship initiative under the EU2020.

It has been pointed out that a role in illustrating the broader impacts of agriculture and agricultural land use in Europe on natural resources, similar to that played by Favourable conservation status for biodiversity in particular, should be played by a well chosen resource indicator. The advantage of resource indicators is that they embody life-cycle thinking that can help avoid shifting the environmental burden between different phases of the life cycle and from one country to another (EEA, 2010). Their use for understanding impacts of agriculture can document trade-offs associated with intensifying farming practices in Europe and the implications for ecosystems in non-EU countries. HANPP ('human appropriation of net primary production') relating to material intensity of land base utilisation, and a specific material flow indicator to account for material intensity of farming practices through physical inputs and outputs associated with agricultural and non-agricultural products (e.g. Total Material Requirement developed by Brigenzu and Schutz, 2001) have been mentioned as plausible candidates. There is a good deal of scientific consensus on the appropriateness and validity of the HANPP indicator for the measuring the land use intensity of the EU agriculture. The HANPP concept would make it possible to demonstrate both the amount of land used for agriculture (and forestry) and its intensity, by measuring how much land conversion and biomass harvest alter the availability of biomass in ecosystems. The work on improving its methodology has begun in the Joint Research Centre of the European Commission. Its broader potential in providing aggregate information on how agriculture is impacting on the nature resource base is clear, although its more rigorous incorporation in the rural development policy cycle or within other CAP measures is not likely. It has been also observed that the HANPP indicator is too complex to explain to the broader public and therefore development of more easily understandable ecological footprint concepts for agriculture would be most welcome.

With regard to a material flow indicator, its potential would be in documenting the intensity of farming practices by accounting for material inputs extracted from natural resources of both domestic and third countries against the backdrop of material outputs (agricultural products), as well as documenting certain hidden flows of agricultural biomass such as those associated with soil erosion and agricultural waste (Brigenzu and Schutz, 2001). This would make it possible to illustrate, for example, the adverse impact on natural resources of the long-term decrease in the share of agriculture in GDP in the majority of the EU Member States and of a concomitant role of increasing material flows associated with imports. Material flows accounting is an integral part of the world-wide system of integrated Environmental and Economic Accounting (SEEA), which has undergone a qualitative analysis in the IN-STREAM project. A large amount of data for the material flow indicator are

already available in national accounts (Brigenzu and Schutz, 2001; Eurostat, 2001), but it has been observed by stakeholders that the importance of the concept has not yet been recognised as an EU or Member States' policy priority.

The impact of rural development measures on climate change mitigation is addressed in the current CMEF set by an indicator relating to the output of renewable energy, which has been noted as too weak, and clearly will be reconsidered and replaced by a more coherent GHG intensity concept. Other gaps have been identified in relation to measuring the impact on other ecosystem services, e.g. introducing a soil related indicator such as soil carbon or soil organic matter in the CMEF system would be a considerable policy improvement.

4.2.3 Successful examples of the use of indicators

The High Nature Value (HNV) indicator development

The operationalization of the High Nature Value (HNV) indicator has been critical for collecting evidence on support for low-input and medium-input farming systems in biodiversity-rich habitats. These farming systems cover about 32 per cent of agricultural land in Europe, varying from 78 per cent in Slovenia to 5 per cent in Denmark. Particular concentrations of HNV farming areas are found in the Mediterranean (e.g. Spain, Portugal, Greece), in Central and Eastern Europe (Romania, Bulgaria, the Baltic countries, Slovenia, Slovakia, parts of the Czech Republic, Austria) and in Northern Europe (Ireland, uplands of the UK). Traditionally they encompass extensive livestock systems, characterised by low productivity, and create hot spots of healthy and viable ecosystems with a high proportion of semi-natural grasslands that have high floral diversity and play a major role in countering soil erosion, maintaining soil organic matter, and protecting watersheds. Despite this, the HNV farming systems have until recently not been considered by agricultural economists as agricultural assets due to their low productivity and labour efficiency, and the environmental benefits they deliver for biodiversity, soil and water have not been recorded in national accounts, nor have these HNV farms been receiving proportionate support from the CAP budget to reflect their contribution to ecosystems services. A concrete example of HNV farming in Basse-Normandie is an extensive HNV sheep farm with a high proportion of semi-natural grasslands and a high floral value, that receives 5.7 times less support than the non-HNV farm types for each hour of work, and 3.5 times more per hectare (Beaufoy and Marsden, 2010).

Much research effort has been invested at the interface between agricultural policy and environmental economics since the 1990s to identify the nature and the scope of these HNV benefits (Baldock, 1999; Andersen et al., 2003). More recently, to develop the details and identify data sources for the composite indicator (Paracchini et al., 2007; IEEP, 2007), and guidance has been produced for Member States on how to apply the HNV indicator (Beaufoy and Cooper, 2008). The data involved in the composite design of this indicator includes data from Farm Structure Survey relating to farm size and structure, from Farm Data Accountancy Network relating to agro-chemical inputs, biodiversity and Natura 2000

datasets held by Member States, and spatial data for landscape elements. The achievement of producing the HNV indicator in an operational form and integrating it in rural development policy in the 2007-2013 programming period is helping to build up a coherent rationale for recognising the benefits of HNV farmland and thus justifying higher amounts of more appropriately targeted support to farming in these areas. It is included in the current CMEF system as a Baseline indicator ('agricultural area under High Nature Value Farming'), a Result indicator ('Area under successful land management contributing to bio diversity and high nature value farming/forestry') and an Impact indicator ('Maintenance of high nature value farmland and forestry').

From the current mid-term evaluation exercise for rural development programmes it appears that success in operationalising the HNV indicator can be seen in Member States that have invested sufficient resources in collecting and integrating composite data (e.g. Austria). In these cases, the political will to provide resources for fully operationalising the HNV indicator at Member State level may reflect the particular weight of maintenance of HNV systems in their sustainability priorities, as well as an endogenous tradition of valuing cultural landscapes which is largely coherent with the HNV approach. Some issues remain in terms of how the indicator has been interpreted by Member States, although the underlying challenge may have more to do with availability of data rather than with the indicator itself (Pepiette, 2011). Some work at EU level is also needed in correlating existing datasets, which vary between Member States due to historical practice, past policy priorities, bio-physical, environmental and climatic conditions and availability of resources

Overall, the HNV indicator can serve as a very good illustration of the concerted efforts needed to establish a measurable parameter for a complex and environmentally important concept. It is noteworthy that its inclusion in the CMEF reflects the fact that HNV farming has been set out as one of the key environmental objectives of the rural development policy in the 2007-2013 period in the Commission's strategic guidelines for environmental land management payments under the CAP. This itself was a response to the lack of appreciation for the environmental benefits of the HNV systems in national accounts, the disproportionately low public support for these systems, and the very immediate related risk of their economic marginalisation and abandonment which would undermine the continuing delivery of HNV benefits for soil, water, biodiversity and cultural landscapes. It is this rigorous linkage between the setting of the new environmental objective for the HNV farming at policy level, and the efforts invested in operationalising the HNV indicator that has laid the ground for developing a robust data series that will be much more useful in evaluating the policy outcomes at the end of the current programming period and over time. This is what made it a successful example.

4.2.4 Future opportunities

At policy level, there are significant opportunities in developing existing legislation related to agricultural and other land use data (e.g. forestry), both statistical and administrative improvements to streamline the data requirements and cover the data needs for

environmental indicators more effectively. A great deal of care needs to be taken to develop the national accounting modules in a way that overcomes the evident problems of diverse cultural and historical accounting backgrounds, and is sufficiently coherent to deliver information with an EU added value (Oenema et al., 2011). This is particularly relevant at times of cash-strapped public budgets. Additionally, an opportunity for taking forward the process for operationalizing a number of existing indicators would further benefit from improving and extending the use of the data network linked to the CAP (Farm Accountancy Data Network) in a way allowing its better correlation with national and European environmental datasets and accounts (Pepiette, 2011). Further problems need to be overcome due to ensure all HNV/extensive farms feature in the Farm Accountancy Data Network

Another opportunity at policy level relates to the potential in the use of resource indicators such as HANPP or material flow accounting. Whilst the potential of the HANPP indicator has been recognised, and a research investment in developing and streamlining the existing methodologies has been made at EU level, the potential of material flows accounting which would benefit from a compilation of economy-wide material balances that are to a large extent already available in a number of Member States (Eurostat, 2001) is not yet recognised as policy priority. Both the HANPP and the material flow accounting would be able to take into consideration the hidden environmental burdens such as soil erosion, decline in soil organic matter, and changes in soil carbon stocks, as well as having the potential to account for emissions associated with indirect land use change. This would bring a considerable added value in the setting of policy priorities at times of CAP reform and strategic and programming changes in rural development. Although new indicator initiatives for extending the national accounts by individual member States may sometimes serve as important examples to demonstrate the potential uses of such indicators in setting national priorities, it will be the steps taken at EU level that are critical for arriving at meaningful methods of EU-wide resource accounting in agriculture.

At data collection level, more information is needed on certain soil characteristics such as soil organic matter, soil erosion, soil carbon and potentially soil biodiversity, as well as on water use in agriculture, water availability, and on other ecosystem services. These data would certainly merit inclusion in national accounts. Significant challenges need to be addressed in particular for soil and water availability information. For soil monitoring and evaluation in particular, the lack of harmonised information at EU level, uncertainties involved in measurements characterising soil conditions, complexities in developing a sufficiently robust suite of indicators to facilitate soil monitoring, and incompleteness and inconsistency of the elements of soil monitoring in place in various Member States are the key challenges. This leads at present to considerable difficulties in undertaking more robust, evidence based impact assessments for soil ecosystem services under agricultural policy. In addition, to be able to continue operationalising the HNV indicator at Member State level and thus improve both the robustness of the available data series and evidence base of the biodiversity, soil and water services delivered by the HNV systems, sample surveys of areas with a concentration of HNV farming have been called for. These should be designed to monitor both trends in farming practices, land cover and biodiversity conditions, as well as

socio-economic aspects. In addition, there is a significant gap in the available data on the distribution, density and diversity of farmland features and habitats (Farmer et al., 2008). This data would significantly improve information available both with regard to the HNV farming systems and to the potential of non-HNV farming systems to deliver on farmland biodiversity as well as soil functionality. This in turn can further inform the agenda of environmental integration in agricultural policy.

At conceptual level, more efforts are needed to deepen the understanding of the burden agriculture puts on the climate change agenda and the role that agriculture can play in contributing to climate change mitigation efforts. With regard to the CMEF suite of indicators, a more comprehensive and robust indicator needs to be found for tracking the climate change impacts occurring in the rural development policy cycle as a result of implementing specific measures, and also to complement the existing indicator for renewable energy production. With regard to the existing indicator for GHG emissions associated with agricultural land use in the EU, developed by EEA/Eurostat, the existing conceptual model has been taken from the IPCC reporting methodologies and enshrined in the EU data collection systems in ways which are not entirely accurate (e.g. the GHG emissions comprises only N2O emissions from soil and CH4 emissions associated with livestock but neglects the CO2 emissions potentially released through soil management, e.g. grassland conversion or draining of peat land associated with agricultural land use) and have been subsequently used in a partly reductive way for modelling the overall impact of agriculture on climate change. This needs to be refined. More complexity in arriving at a net picture of the combined impact of agriculture on climate change could be generated by considering the existing indicator together with indicators for water quality, land cover, land use and HNV farmland. This would enable considering reductions in nitrogen that have impacts in terms of GHG emissions reduction and vice versa; biomass and biofuel cropping that have implications on water demand, biodiversity and on pressure on land for food production). Such composite information would be an invaluable opportunity for a better recognition of deleterious impacts of agricultural land use, as well as for setting suitable objectives of the CAP measures in future.

4.2.5 Policy recommendations

From the information analysed in this section it transpires that there is both some low-hanging fruits for a better use of sustainability/environmental indicators and persisting gaps which call for further work to be done, involving:

- Further efforts in refining and extending the CMEF indicators based on lessons learnt from the current experience;

- Improvement of evaluation practices in Member States with regard to undertaking mandatory evaluations for biodiversity and HNV farming in particular, as these receive the least attention in many Member States, and with regard to adequacy of resources being put into the monitoring and evaluation at Member State level;

- Reinforcing robustness of methods for data aggregation for the HNV indicators;

- Scoping the feasibility of using resource indicators, such as the indicator for 'human appropriation of net primary productivity' (HANPP) which has been analysed in the IN-STREAM project, to develop the aggregate information on the utilisation of the natural resource base in agriculture; more resources to be put in methodologies for new ecosystem indicators such as soil and water availability indicators;

- More efforts to streamline and harmonise the data collection for the existing 'agri-environment' indicators through Farm Structure Survey/Eurostat.

4.3 Fishery policy

4.3.1 Key policies where indicators have a role to play

EU Common fisheries policy

Fisheries Policy is an exclusive competence of the European Union (EU). This means that all decisions are taken at the EU level. Member States cannot intervene in fisheries management unless they are explicitly delegated back the powers to do so. At present the main area for which Member States have been given such powers relates to inshore fisheries (within maximum 12 nm). EU waters beyond these coastal waters are regarded as 'one big pond' (Brown, 2006). The Common Fisheries Policy (CFP) thus provides *the* framework for European and national fisheries management activities.

The CFP was adopted in 1983, and has since been the subject of two reviews, in 1992 and 2002. The 1992 basic Regulation clearly stated the aims to protect and conserve the marine aquatic resources. Furthermore, it included a requirement to take account of the implications on the marine ecosystem when adopting management measures (CEC, 1992). The main objective was revised in 2002 during the reform and is set out in Article 2(1) of Regulation 2371/2002. It states that:

> '*The Common Fisheries Policy shall ensure exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions.'*

The CFP also defines the 'progressive implementation of an eco-system-based approach to fisheries management' as one of its objectives (CEC, 2002). In meeting this and other environmental obligations, growing emphasis is being placed on monitoring and reporting the effects of the CFP on fish stocks and the wider marine environment. Furthermore, it stipulates that the CFP shall provide for coherent measures concerning:

a. conservation, management and exploitation of living aquatic resources,
b. limitation of the environmental impact of fishing,
c. conditions of access to waters and resources,
d. structural policy and the management of the fleet capacity,
e. control and enforcement,
f. aquaculture,
g. common organisation of the markets, and international relations.

In the Green Paper on the Future of the CFP during the 2002 reform, the Commission emphasised the central role to be played by monitoring and indicators (CEC, 2008). The development of fisheries/environment indicators also received political support from the Fisheries Council in its Conclusions submitted to the Gothenburg Summit in June 2001. This

referred to the 'need to develop specific indicators for the fisheries sector to measure on an integrated basis ecological, economic and social sustainability. The indicators should enable monitoring of key parameters of important fish and shellfish stocks, evaluation of time trends in such stocks and assessment of potential impact on bio-diversity.' These commitments were further developed in the Community action plan to integrate environmental protection requirements into the CFP (COM(2002)186), suggesting that the development and testing of indicators will be a first step to improve monitoring and evaluation of the process of environmental integration. This approach was endorsed by the Council at its meeting on 27-28 January 2003. Since that time, significant progress on the development and use of the indicators in support of the implementation of the CFP has been made and indicators are used at various points in the fisheries policy cycle.

Integrated Maritime Policy

Beyond fisheries management, indicators are also being developed for the use in broader marine management. In 2008, recognising the need for more coherent and improved management of the marine environment, the Commission adopted the Integrated Maritime Policy (IMP). The environmental pillar of the IMP is the Marine Strategy Framework Directive (MSFD) (2008/56/EC) was also adopted in 2008. The overall objective of the MSFD is to achieve good environmental status (GES) for the marine waters by 2020. It does this by requiring Member States to determine good environmental status for the marine waters over which they have jurisdiction, in each marine region and then for the Member States to develop Marine Strategies with Programme of Measures to tackle the pressures on the marine environment which would prevent the achievement of GES.

By 2012 Member States will need to have made preliminary assessments of Europe's seas by determining the characteristics of GES, identifying targets and indicators to be achieved and setting up monitoring programmes. By 2015 they will need to have developed a programme of measures for each marine region and sub-regions, with each programme setting out how to achieve good environmental status by 2020 (or maintain it if it is already present).

Like the CFP, the MSFD calls for the implementation of a precautionary approach. It can be inferred that this emphasis on GES is one way of trying to gain greater certainty for environmental indicators. Annex I of the MSFD contains a list of 11 qualitative descriptors which can be used in implementing good environmental status. These include:

- Biological diversity is maintained.
- Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems
- Populations of all commercially exploited fish and shellfish are within safe biological limits
- All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

On 1 September 2010 the Commission published a Decision on criteria and methodological standards on 'good environmental status' (GES) of marine waters (Decision 2010/477/EU) to assist in the implementation of the marine strategy framework Directive (MSFD). The Decision is based on the work of the Joint Research Council (JRC) and International Council for the Exploration of the Sea (ICES)[36] provides indicators for measurement or assessment of the qualitative descriptors. For example, under the descriptor, 'habitat /community state', there are a number of criteria including' community condition' for which four indicators are specified: Species composition, relative population abundance, community biomass and functional traits which would be used to assess the descriptor. These indicators should add value to and be supportive of the list of indicators already used in the CFP policy cycle. As highlighted in Figure 1, it is likely that these indicators which will be used to define good environmental status are likely to contribute to point A in the policy cycle, specifically in the analysis of the problem, in particular, the state of the marine stocks.

4.3.2 Use of sustainability indicators at present

A substantial amount of work on fisheries indicators has been carried out, especially in Northern Europe in the last decade. The European Commission remains committed to developing indicators to measure progress on environmental protection requirements under the CFP and have funded some key research projects in support of their development. In general, however, very few indicators are actually in use and even fewer are used to evaluate management actions. The main challenge is to find suitable indicators corresponding to different elements in the management framework/policy cycle (see Figure 1) and these are described below. Indicators are largely used at all stages in the policy cycle A (problem recognition) – E (evaluation and reporting).

Traditionally, single species and target stock indicators for the regions which are members of the International Council for the Exploration of the Sea (ICES) were developed by ICES and are used by the European Commission in fisheries management under the CFP. They were then refined to stock specific reference points based upon a 'precautionary approach', relating principally to spawning stock biomass and fishing mortality rates. Traditional empirical indicators also include catch per unit effort (CPUE) for stock size abundance, mean weight of population sampled and area distribution are used at the assessment phase of the fisheries policy cycle. These indicators are dependent on data from surveys at sea, sampling of catches and even from interviews or monitoring fishermen. Other biological indicators currently used in stock assessments include 'the average size of fish' and 'the mean trophic index' (Anon, 2010). In their annual assessments of EU fisheries s assessments, ICES currently uses four of the IN-STREAM indicators which have undergone

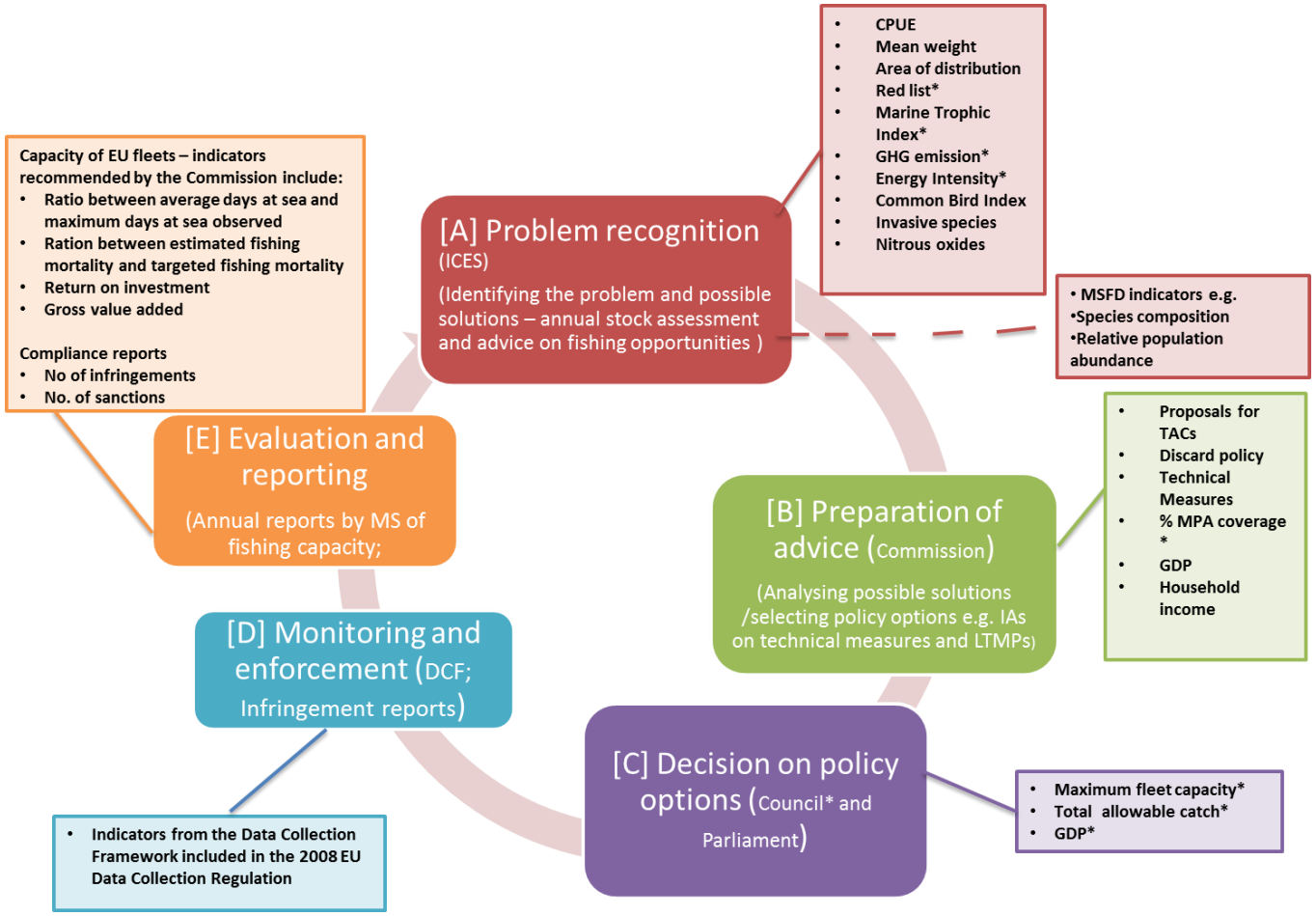
[36] JRC and ICES (2010) Scientific support to the European Commission on the Marine Strategy Framework Directive Management Group Report. March 2010. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/13626/1/management%20group%20report_final_vii.pdf

qualitative analysis. These are the Red List, the Marine Trophic Index, GHG emission and energy intensity and they are largely used at the policy recognition phase of the policy cycle. Apart from these, ICES uses other indicators including the Common Bird, Invasive Species and nitrous oxides indices at same stage in the policy cycle.

Most other IN-STREAM indicators are not used in the current fisheries policy cycle. The World Bank's adjusted net savings (Genuine Savings) indicator could have been relevant if it had taken the depreciation of fish stocks into account. Its failure to do so has been identified as one of the limitations of this indicator as it fails to adequately account for the depletion of a range of key natural resources.

The policy cycle below provides an overview of the main delivery Instruments of EU's Fisheries policy and the stages of the policy cycle. Indicators relevant at the different stages of the cycles (and used in relation to some of the implementing instruments) are identified.

Figure 4.8 Fisheries Policy cycle post-2013: current and potential indicators



Since 2002, the CFP requires the progressive implementation of an Ecosystem Approach to Fisheries Management (EAFM). This will include the integration of environmental protection requirements into the CFP, including measures to 'limit the environmental impact of the CFP'. The EAFM requires that managers take account of a wide range of fisheries impacts when setting objectives and attempts to meet these objectives will need to be supported by reliable scientific and effective management decision-making. Indicators can support the decision-making process by 1) describing the pressures affecting the ecosystem, the state of the ecosystem and the response of managers 2) tracking progress towards meeting management objectives and 3) communicating trends in complex impacts and management processes to a non-specialist audience. This will require the development of specific indicators to measure on an integrated basis ecological, economic and social sustainability.
In 2004, after a period of consultation with the Commission's Scientific and Technical Committee, the Commission selected a preliminary set of indicators of environmental integration (SEC (2004)892). Based on an appreciation of data availability and an estimation of the time-scale in which their implementation may become effective, 1st order and 2nd order indicators were distinguished (see Appendix II). Since 2004, the Commission has funded some key projects (INDECO and INDENT) where these indicators have been refined, evaluated and tested. In 2008, the EU Data Collection Regulation (DCR) was reviewed and the new Data Collection Framework (DCF) included data collection in support of a selection of first order indicators.

In addition, indicators are currently used in the assessment of overcapacity in EU fleets. Fleet management is an area of the CFP that changed substantially during the 2002 reform, in response to the need to achieve a balance between fishing capacity and available resources. Since 2002, the task of drawing up capacity management plans was given back to Member States (CEC, 2002). Furthermore, Member States are obliged to report annually to the European Commission on their efforts to achieve a sustainable balance between fishing capacity and fishing opportunities. On the basis of this information, the European Commission produces a summary report for the European Parliament and the Council.

In March 2008 DG Fisheries and Maritime Affairs (DG MARE) issued new 'Guidelines for an improved analysis of the balance between fishing capacity and fishing opportunities' to assist Member States with their reporting. This was in response to the difficulties faced by Member States' in reporting on the links between fishing capacity and fishing opportunities highlighted in the 2004–2006 reports (DG Mare, 2008). The recommended indicators in the 2008 Guidelines resulted from two STECF working groups, which met in October 2007 and February 2008. These indicators were originally developed between 2000 and 2002 as part of the Economic Interpretation of the Advisory Committee on Fisheries Management (ACFM) Advice (EIAA) model, through a series of EC-funded research initiatives[37]. Some of these have already been used earlier in the series of three Annual Economic Reports on the

[37] EAFE, 2002. The potential economic impact on selected fishing fleet segments of TACs proposed by ACFM for 2002 (EIAA –model calculations). A report of the European Association of Fisheries Economists Advisory Committee (EAFE–AC report), 28pp. Available at: www.eafe-fish.org/notices/eafe-ac-eiaafinal.doc

economic performance of selected European fleet segments that were submitted to the STECF between 2002 and 2004[38].

The list of indicators includes one technical, three biological, two economic and two social indicators.

- *Technical indicator:* (T1) ratio between average days at sea and maximum days at sea observed in a fleet segment.
- *Biological indicators: (*B1) ratio between estimated fishing mortality (F) and targeted fishing mortality (F_t) of stocks exploited by the fleet segment; (B2) ratio of current catch weight of species and the estimated biomass of the stock exploited attributed to fleet segments according to their share of Total Allowable Catch (TAC); and (B3) Catch per Unit Effort (CPUE) measured in catch weight per days at sea of a fleet segment.
- *Economic indicators: (*E1) return on investment (ROI); and (E2) current revenue against break-even revenue per segment.
- *Social indicators:* (S1) average wage per Full-time equivalent (FTE); and (S2) gross value added (GVA) of the activity of the fleet segment.

The Commission identifies the technical indicator to be of primary importance as it is based on robust data and provides the only quickly calculated reference for a fishing capacity potential in prevailing circumstances for the fishing activity. Furthermore, the Commission recommends that, as a minimum, the technical indicator should be applied to all fleet segments as a baseline.

In addition to the technical indicator, the Commission refers to the importance of the biological indicators as very important, as 'a healthy resource base is a prerequisite for sustainable exploitation'. The Commission recommends indicator B1 (ratio between estimated and targeted fishing mortality) as the best indicator, although it acknowledges that the calculation and interpretation of this indicator will need support from fisheries scientists. Whilst the use of the indicators is not mandatory, Member States are urged to use them in their national reporting on the capacity as the indicators can be useful. For example, the economic and biological indicators can be combined to provide a warning system, as illustrated in Annex 2 of the Commission Guidelines.

Finally, the Commission routinely uses a suite of ecological, economic, social and governance indicators in evaluating the options for various fisheries conservation measures, including the impacts of long term management plan proposals and technical measures such as the EU discard policy.

[38] Further model developments and an overview of the EIAA model are also described in EC (2005). Commission Staff Working Paper: Report of the Joint SGRST-SGECA Sub-group on 'Further improvements on the EIAA model including long term perspective and effect of recovery plans".

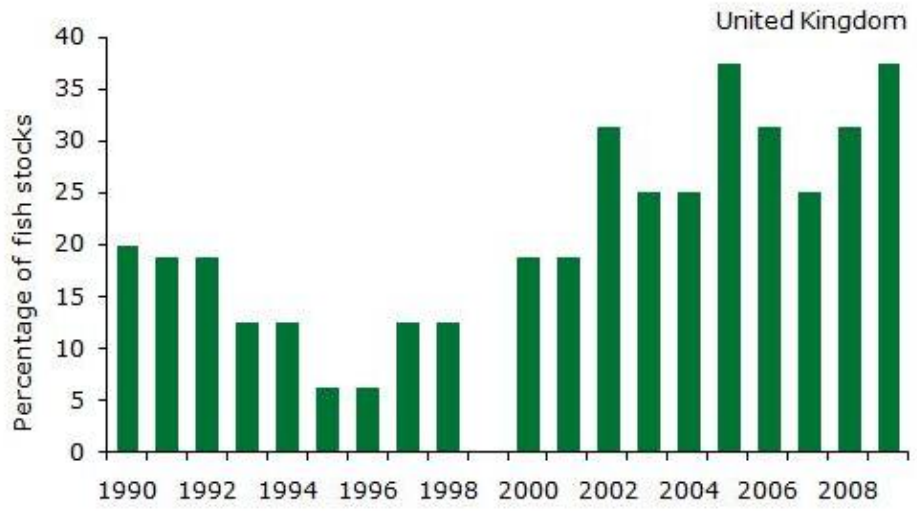
4.3.3 Successful examples of the use of indicators

As outlined in the previous sections, indicators used in the current fisheries policy cycle are still in development. Whilst a number of these indicators are used to assess trends and impacts, the success of most of these indicators are dependent on availability and quality of data. One specific example of the use of indicators is at the problem recognition phase of the policy cycle. In particular in stock assessment and the description of the state of stocks as overfished or depleted, for example.

At the European level, each year ICES undertakes fisheries assessments of all commercial fish species in the three regional seas, the North Sea, the Baltic Sea and the Mediterranean sea. ICES classifies a stock status by comparing the quality of mature fish (spawning stock biomass (SSB) and the rate at which the fish is exploited (fishing mortality). For 2010, this information has been used to estimate the proportion of overfished stocks in the Atlantic and nearby seas as 63 per cent which indicates an improvement from the position in 2004 where 94 per cent of fish was overfished (DG Mare,2011) This information is used to prepare the annual report on he state of Europe's fish stocks where there is good data These indicators (SSB and fishing mortality) were used to provide an update on fish stocks which then forms the basis of proposals on annual fishing opportunities by the Commission to the Council and the annual quota setting by the Council of Ministers.,

At the national level, the JNCC, the UK Statutory conservation body recently combined the two indicators for which there are reliable estimates, SSB and fishing mortality, into one pressure indicator 'sustainable fisheries' to show the percentage of fish stocks in seas around the UK that are both harvested sustainably and are at full reproductive capacity. They did this for 16 stocks for which there are reliable estimates of the two individual indicators for the fish stocks of major importance to the UK fishing industry. This is based on a group of 16 indicator for which there are reliable estimates of fishing mortality and spawning biomass and which together represent fish stocks of major importance to the UK fishing industry (JNCC, 2008). The proportion of the assessed fish stocks harvested sustainably and at full reproductive capacity varied between zero per cent and 20 per cent in the period 1990 to 2000. In 2000 it was 19 per cent, and the three-year average of the 1999 to 2001 period was 13 per cent. In 2009 it was 38 per cent. The assessment of change for the indicator is therefore positive in both the long and short term (see Figure 4.9) and this information is vital to the UK, as it allows for continuous improvement to ensure that management decisions contribute to sustainable fisheries. This is critical component to the UK's implementation of the Marine and Coastal Areas Access Act (2009) which aims to ensure clean, healthy, safe, productive and biologically diverse oceans and seas, by putting in place better systems for delivering sustainable development of marine and coastal environment (JNCC, 2011).

Figure 4.9 Percentage of fish stocks harvested sustainably and at full reproductive capacity, 1990 to 2009 (JNCC,2009)



Notes: Based on 16 stocks for which accurate time series are available derived from stock assessment reports

Source: International Council for the Exploration of the Sea, Centre for Environment, Fisheries and Aquaculture Science

4.3.4 Future opportunities

The impetus is growing for EU fisheries management to be improved and advanced in response to the CFP reform and the need to meet both European (CFP and MSFD targets) and international targets (MSY and CBD). The recently completed 'IMAGE' project funded by the Commission concluded that significant work is still required to understand the links between pressure and the value of the indicators. Most indicators in the fisheries context have been developed in the Pressure-State-Response framework. However, the focus has largely been on state indicators.

On specific types of indicators, that is, ecological, social and economic indicators, there is still a need to develop indicators on other components of the marine ecosystem. At the moment, while many indicators exist, they are heavily skewed towards ecological indicators describing the state of the ecosystem. At the general policy level, two opportunities for making progress on fisheries indicators are the reform of the CFP in 2012 and the implementation of the MSFD. In the former, the draft regulation is due to be published on 13 July 2011 and will define the new objectives for the CFP post 2013. It is expected that these objectives will be more clearly defined than in the current CFP and this would further enhance the development and use of indicators in the fisheries policy cycle.

The initial assessment of current environmental status of a Member State's waters and a determination of what good environmental status means for these waters is to be completed by 2012 and targets and indicators will used to show whether a Member State is achieving GES is also to be established by 2012. A further opportunity for both the development of indicators and the establishment between pressure and state indicators is expected as Member States will also have to develop a programme of measures by 2015 which will include descriptors of GES which may be impacted by fishing.

Fisheries in national environment economic accounts

The SEEA (2003) clearly recognises the need and the opportunities for detailed reporting on fish stocks, their value and expenditures associated with, inter alia, support to the fisheries sector. In May 2011 the European Parliament adopted a regulation on European environmental economic accounts, which aims to aid the collation and comparability of data which is already collected by most Member States. Despite the existence of rather unambiguous recommendations in the SEEA (2003), the revision was not used to include all data potentially relevant to fisheries in the system of national accounts. It requests regular reporting of data on 'Fish capture and other aquatic animals and plants, raw and processed' in its Annex III, dedicated to the module for economy-wide material flow accounts. Consideration should be given to expand the range of data relating to fisheries to be reported in the next reform. A separate module for data on fisheries could be created.

Management of fisheries includes expenditures for fisheries management purposes, monitoring, control and surveillance, data collection, expenditure of the local, regional and national fisheries management authorities (such as fisheries management bodies), temporary costs for facilitating structural adjustments of the fisheries sector (for example vessel buy-back programmes, re-training) and research (SEEA,2003).

4.3.5 Policy recommendations

In order to enhance the use of indicators in the fisheries policy cycle the following are recommended:

- The CFP objectives need to be clearly defined. The EU-funded project, IMAGE, recommended that the high level objectives should be clearly defined allowing for more flexibility at the regional scale to allow for development of indicators relevant to regions.

- Financial support for research on projects focused on how to operationalize the use of indicators in the fisheries policy cycle. This will include more support for projects to understand the links between pressure and state indicators, pressure and response indicators and understanding the links between the three types of indicators.

- Consideration should be given to requesting that a broader and more detailed set of data is reported under the regulation on environmental economic accounts in its next revision of the Data Collection Framework. In particular, data to support the assessment of cost of over-exploitation and the benefits from efficient management of the aquatic resources exploited by commercial fisheries. Facilitate the exchange of information between policy areas e.g. biodiversity and fisheries to make the best use of indicators/information etc. that is being developed in those policy areas but which may be beneficial to both

- Further development of socio-economic indicators for use in all phases of the policy cycle

- The development of indicators for monitoring the performance of the CFP and the MSFD over time.

- If methodological improvements of the adjusted Net Savings (Genuine Savings) indicator are to be attempted, consideration for it to take depletion of fish stocks into account should be given.

5 Resource efficiency

'If the present growth trends continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years'. (Meadows, 1972)

'In 1972 the model showed a time of crises 50-70 years into the future; now the crises appear 10-30 years in the future'. (Meadows, 2005)

Key messages

- It is of foremost importance to **reduce the environmental impacts related to resource consumption**. To do so, resource efficiency indicators and targets should be set.
- It is not yet possible to create robust indicators on the impacts of resource use. The current focus should therefore be on **absolute amounts of resource used** for which statistics exist and are collected by national governments. In addition resource intensity indicators (resource use per unit output) will be valuable.
- Attention will be needed to **develop data sets on stocks of materials**, as flows on their own do not address over-consumption of either renewable or finite resources. A focus on stocks particularly links to the **identification of sustainability thresholds**, whether for renewable or non-renewable resources.
- The further development of a range of **sustainability indicators for resource use**, should be made a priority. Useful examples are the Environmentally Weighted Material Consumption (EMC), the Total Material Requirement (TMR) and the Total Material Consumption (TMC), Raw Material Consumption (RMC).
- Within the 'Footprint family' of indicators (see Gallo et al., 2011) the **Water Footprint and the Carbon Footprint** may be considered potentially more informative for resource efficiency policy than the Ecological Footprint: whereas the Ecological Footprint aggregates different categories in one indicator and is applied at the country level, Water and Carbon Footprints have the advantage of focusing on only one environmental category and can be applied at the country, sector, company, household and product level.
- It will be useful to asses the 'footprint' of wider product use – e.g. wood, soy, biofuels, palm oil, coffee, cocoa – especially in a global context and develop associated indicators to inform decision making and take third country impacts into account.
- The potential relevance of the **Index of Environmental Pressures and the World**

Bank's Adjusted Net Savings (ANS, also known as Genuine Savings) for energy efficiency policy could be further investigated. ANS can be relevant in the resource efficiency discussion as far as it includes a component recording trends in stocks of certain natural assets and provides the opportunity to investigate the links between different capital stocks and monitor resource efficiency relevant information. One can expect that the index will be sensitive to improvements in resource efficiency as these should reflect in changes in a whole range of the component indicators (variables) on which the index rests.

- Within the resource efficiency policy cycle, the '**problem recognition' and 'problem exploration' stages have been the focal area of indicator development to date**. The development of indicators for the stages of 'policy option design and implementation' has so far proven more limited.

- An appropriate **use of indicators in sectoral policies** will be crucial for target setting and monitoring of resource use by e.g. specific sectors of the economy and/or products.

- Focus will be needed in particular on those sectors with the largest environmental impacts and where significant amounts of resources are used. In this regard, three consumption areas are responsible for 75-80 per cent of our environmental impacts: **housing, food and drink, and mobility**. These sectors are clear priorities for achieving greater resource efficiency.

- Resource scarcity is a global issue. Therefore, it is not enough to consider domestic activities only. EU policies and indicators should **take into account environmental impacts occurring abroad** that are driven by national or European demand for imported goods

'Resource efficiency' has become the new buzzword in European environmental policy, with great ambitions for innovation-led resource efficiency to allow a decoupling of resource use from economic growth. The anticipation is that a new drive on resource efficiency would address resource limits, facilitate competitiveness, safeguard and create jobs, address environmental impacts and allow a continuation of the current consumption led economic model, much like innovation was able to do in the years after the Club of Rome report 'Limits to Growth'. There is clearly a vast potential agenda for resource efficiency actions across many policy areas with major opportunities for progress. Having improved indicators on resource efficiency across the policy cycles offers to help 'measure to manage' better and contribute to progress towards a sustainable, resource efficiency, green and potentially equitable socio-economy. This section provides an overview of key recent policies relevant to the context of resource efficiency, and highlights where such indicators could be used to inform such policies.

Resource efficiency describes the use of resources such as materials, energy and water in order to minimise waste, thereby reducing costs. Although the most recent elaboration of EU

natural resources policy has been called 'resource efficiency', its political scope is much broader than the above description, encompassing sustainable use of natural resources and reaching out to related policy fields such as agriculture, biodiversity, climate change, industry, innovation and transport. Therefore, 'resource efficiency' within this context should be understood beyond the narrow description of efficient use of resources.

The EU's Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan published in 2008 recognises that Europe's society – in the way it produces and consumes – contributes to global warming, pollution, material use, and natural resource depletion. It identifies a need to move towards more sustainable patterns of consumption and production. The Action Plan outlines a 'dynamic framework' to improve the energy and environmental performance of products and foster their uptake by consumers. This framework includes minimum requirements for products, product labelling, a green public procurement initiative, and actions for 'smarter consumption'.

Adding to this, the most recent EU economic strategy, Europe 2020, is based on a series of 'flagship initiatives', including one on resource efficiency. According to the flagship initiative document, its aims are 'to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy which will help us to: boost economic performance while reducing resource use; identify and create new opportunities for economic growth and greater innovation and boost the EU's competitiveness; ensure security of supply of essential resources; fight against climate change and limit the environmental impacts of resource use.' A Resource Efficient Europe Roadmap 2050 is expected later in 2011, which the resource efficiency flagship initiative document states will 'define medium and long-term objectives and means for achieving them with the main aim to decouple economic growth from resource use and its environmental impact.'

The resource efficiency flagship initiative further mentions that indicators are needed 'to cover issues such as the availability of natural resources, where they are located, how efficiently they are used, waste generation and recycling rates, impacts on the environment and biodiversity'.

Currently, Eurostat lists resource productivity among its eleven SDI headline indicators, and in August 2010, the European Commission's Joint Research Centre (JRC) published a new type of life cycle-based indicators for quantifying and monitoring progress towards sustainable development. The JRC developed three sets of indicators on resources (including resource efficiency, eco-efficiency, resource productivity, and resource-specific impacts), products (focusing on products' environmental impacts) and waste (covering the entire waste management chain).

On a specific sub-set of resources, the EU launched a Raw Materials Initiative (RMI) in 2008 and an updated Communication was published in February 2011. The RMI focuses particularly on materials used in electronics, the vast majority of which are not available domestically in Europe and for which supply can and has been unstable in the past few years. As many of these materials are important for products that would make contributions

to a low-carbon economy, such as electric vehicles, photovoltaic panels, and other electronic appliances, they were deemed worthy of a specific policy initiative. However, thus far most of the focus is on access or supply of the raw materials, and relatively less attention given to resource efficiency and recycling activities. In any case, the recycling activities relate to both product policy (particularly the Ecodesign Directive) and waste policies (especially the 'Recycling Directives') so it is likely that the same indicators developed by the JRC could be used to measure progress in the RMI.

Indicators will also be relevant for the definition of resource efficiency targets which are likely to be set by 2013 following a consultation, according to the latest draft of the Roadmap prepared by the European Commission. In early 2010, Janez Potočnik, European Commissioner for Environment, stated that 'the concept of resource efficiency will be central [...], but whenever we discuss setting targets we need a careful approach'. The ultimate concern would be to reduce the environmental impact, and he would consider setting targets, but the question would be first and foremost how to set targets. Given that it is not yet possible to create credible indicators on impacts of resource use, it is more immediately relevant to focus on absolute amounts of resource used for which statistics exist and are collected by national governments, despite this providing only part of the picture of sustainable use of natural resources.

A Regulation on national environmental economic accounts, proposed by the European Commission in April 2010 was adopted by the European Parliament in mid-2011. The Regulation provides the legal basis for mandatory regular reporting by Member States on, amongst other elements, economy-wide material flow accounts made up of a range of resources. Separate to this, work on the development of indicators addressing the impacts of different resources would still need to continue, to complement the absolute amounts. This is underway within the JRC, which is working on an indicator that makes improvements to the EMC (environmentally weighted material consumption) work done in the early 2000s, which was deemed to not be robust enough in allocating weighting to impacts. Attention will also be needed to develop data sets on stocks of materials, as flows on their own do not address over-consumption of either renewable or finite resources. A focus on stocks particularly links to the identification of sustainability thresholds, whether for renewable or non-renewable resources. In the continuing absence of scientific evidence of such thresholds, policy objectives cannot be based on anything more than politically negotiated limits. Despite this lack of scientific evidence, clear policy objectives are needed in advance of the evidence, to ensure the changes needed to put European economies and societies on the path towards sustainable resource use.

At a Eurostat conference on Statistics for Europe 2020 held in March 2011, Commissioner Potočnik made it clear that the ultimate objective would be that resource efficiency thinking finds its way into all policies and that it steers businesses, investors and consumers towards the systemic and cultural changes necessary to achieve a green and competitive economy. He emphasised the importance of being able to demonstrate and measure progress if these objectives are to be achieved. The Commissioner pointed out that the Europe 2020 flagship initiatives, including the one on resource efficiency, will be monitored by indicators.

While the above illustrates how the Europe 2020 strategy has so far already translated the concept of resource efficiency in a number of Strategic Documents, there remains a need to set clear objectives and make clear reference to indicators to guide policy-makers and other stakeholders. Recent developments suggest that, given enough political support, the large amount of data increasingly collected on resource use by statistical offices and the work of researchers on resource limits, ecosystem limits and impacts associated with resource use across the EU, should ultimately allow indicators to support the development and monitor the implementation of policies, steering innovation towards increased resource efficiency.

5.1 Resource efficiency policy

5.1.1 Key policies where indicators have a role to play

EU natural resources policy is still in the process of being developed, the issue has recently reached a new momentum with resource efficiency being prominently included in the Europe 2020 strategy. Europe 2020 is currently the main driver of natural resources policy, alongside some associated policies (such as the Raw Materials Initiative). Europe 2020 includes a 'flagship initiative' on resource efficiency, which was published in early 2011, and a Resource Efficient Europe Roadmap is also to be produced later on in the same year. These initiatives are therefore the most immediately relevant for considering the use of resource efficiency indicators.

Existing relevant horizontal and overarching policies cannot be a driver of substantial change on their own but it will nevertheless be necessary for them to undergo a revision to integrate newly developed indicators for macro-level monitoring. These will need to refer to agreed targets set for resource efficiency policy at the highest strategic level (Fedrigo-Fazio, 2011; JRC, 2010). Specific policies falling in this category which need to be strengthened through consistent/adapted indicator approaches include:

- EU's Sustainable Development Strategy
- Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan
- Product policy tools such as the European Ecolabel and green public procurement product groups, as well as the Ecodesign Directive which is meant to be revised in 2012.
- End-of-life of products as a leverage for a higher material and energy resource efficiency and reduced environmental pressure of waste management as addressed in the Thematic Strategy on the Prevention and Recycling of Waste.
- Raw Materials Initiative
- Cohesion Policy

Care will have to be taken to ensure that the indicators are consistent between instruments—such as Ecodesign, Ecolabel and Green Public Procurement—so that policy

measures taken in view of these macro-level indicators are effective and that the improvements achieved are appropriately reflected (JRC, 2010b).

Aggregated/composite macro-level indicators (e.g. Direct Material Input, Domestic Material Consumption) will continue to be needed for the overall identification of the problems related to resource use and would be useful if overall targets, for example in the use of certain materials, were to be set in an overarching policy. In addition, middle- and micro-level indicators will also be needed. These can be a mixture of disaggregated versions of the aggregated/composite indicators, as well as other middle or micro indicators.

Given that natural resources are used in most human activities, focus will be needed in activities where the largest environmental impacts are made and where key and/or significant amounts of resources are used. The resource efficiency flagship initiative already begins a sectoral approach, identifying the need for a coherent and integrated approach across policy fields such as agriculture, biodiversity, climate change, energy, and transport; and the Raw Materials Initiative addresses materials used primarily in electronic products. The 'Recycling' Directives also address particular products, specifically batteries, end-of-life vehicles, electrical and electronic equipment, and packaging.

Therefore as natural resources policy/ies develop, sectoral policies will be key, as will an appropriate use of indicators in such policies for target setting and monitoring of resource use by e.g. specific sectors of the economy and/or products. This is because quantitative reduction in resource throughput, which should be the central objective in achieving sustainable methods of production and consumption, must happen along the value chain (Giljum et al., 2011). 75-80 per cent of our environmental impacts are made in three key consumption areas: housing, food and drink, and mobility. Therefore these sectors are clear priorities for the integration of resource efficiency targets into new and existing policies, such as:

- Water Framework Directive (e.g. water scarcity, depleting aquifers, competition for water use, pollution of water, water pricing and cost recovery).
- Industrial Emissions Directive (e.g. NOx, SOx particulates, CO2, relative/absolute decoupling, embedded emissions).
- Common Agricultural Policy (e.g. land take, material inputs (fertilisers, pesticides and impacts) e.g. eutrophication).
- Common Fisheries Policy (e.g. resource inefficiency, (un)sustainable yields, impacts on stocks, wider ecosystems, time horizons)
- Energy Policy (e.g. security, biofuels: inputs and impacts)
- Transport Policy (e.g. from a CO2 emissions focus to a multi-criteria resources focus, relative and absolute decoupling, impacts on habitat fragmentation)
- Biodiversity Policy (e.g. species and ecosystem services, connectivity, resilience)
- Housing (e.g. resource efficiency of buildings, land-use)
- Food and Health policies (e.g. change in diets, reduction of consumption of animal products, etc.)
- Product policy (e.g. energy efficiency of household appliances, water efficiency)

Ultimately, the comprehensive set of indicators needed to implement resource efficiency policy across sectors and levels of governance (from the micro to the macro level) will cover not only the global and national flows, but also the sector, company and product level. Such a comprehensive set of indicators has already been developed, complying with a range of criteria and covering the categories of abiotic and biotic materials, water, and land area and greenhouse gas emissions/energy use as these were identified as the most important aspects of natural resource use. The Wuppertal Institute suggested using 3 headline indicators, i.e. abiotic material consumption, GHG emissions and land use (Bringezu 2011; Bringezu and Bleischwitz 2009). It has been suggested that such a set could be applied consistently across a range of policies and applied across various levels of economic activity (Giljum et al., 2011). Indeed, if the gap between the more general overarching policies and the detail needed for more precise implementing measures or process values is not bridged this will continue to be an obstacle to the on-the-ground implementation of clearer resource efficiency or sustainable resource use measures (Fedrigo-Fazio, 2011).

5.1.2 Use of sustainability indicators at present

Given the nature of the challenges associated with resource use, it is necessary to develop systems which measure absolute resource use as well as its environmental, economic, and social impacts through appropriate indicators (Giljum et al. 2011). Apart from the notion of decoupling of economic growth from resource use and its related impacts, which implies the automatic use of some indicators, most notably GDP, the scope for the creation of a list of relevant indicators in this broad policy area is potentially very far reaching. Indicators for monitoring of impacts throughout the life-cycle, resource flows and consumption of resources would in particular more immediately support the implementation of more targeted resource efficiency measures in areas such as energy generation and use (fossil and non-fossil) and key natural resources (e.g. water or rare earth metals). Further work would still be needed to develop indicators capturing stocks of resources and the impacts of their use, in order to provide a more realistic picture of sustainable resource use.

Data availability has proved to be a persistent challenge to the development of indicators useful in policy-making in the area of resource use and resource efficiency. As a result, there is currently more to report on the progress in making data available for the development of indicators than experience with the use of indicators to guide policy-making. While much remains to be done, future EU policy can build on current developments, particularly in the establishment of the Eurostat *Environmental Data Centre on Natural Resources and Products*, and the entering into force on August 11 of the new Regulation on European environmental economic accounts, which makes the submission of national environment accounts (including data on material flows) to the European Commission a mandatory requirement[39].

[39] The Regulation on European environmental economic accounts (COM(2010) 132 final) is expected to reach 1st reading agreement by mid-2011.

So far much environmental data was collected by member states on a voluntary basis: since the mid-1990s, experience with collection and analysis of relevant data has grown, supported by a 'gentleman's agreement' between the European Commission and Member States to report on some key indicators (see below what these are). In 1994 the European Commission identified the main lines of action for the development of a Green National Accounting framework based on satellites to National Accounts (EC, 1994). Since then, Eurostat, in collaboration with Member States' statistical offices, has assisted European countries in collecting data through some pilot studies. Most common are physical flow accounts on air emissions (including greenhouse gases) and on material consumption and monetary accounts on environmental taxes. There has also been some progress towards natural capital accounts and System of Environmental and Economic Accounting (SEEA) (EEA, 2006/ 2010; Weber 2007).

In view of harmonising methodological approaches to allow for a reporting on material flows, international working groups on MFA, standardisation for accounting and analysing material flow at the national level were set up in the 1990s. As a result of this project, Eurostat (2007) and OECD (2007) published recommendations in methodological guidebooks. Material flow-based indicators on the economy-wide level, comprising input, consumption, trade and productivity have therefore arguably, to a certain extent, been integrated in the EU's Structural Indicator Set (Giljum, 2011; Eurostat, 2007). Indeed, a whole range of indicators can already be derived from national flow accounts and some of them, such as Domestic Material Consumption (DMC), are already formally part of the EU's Sustainable Development Indicator set (Eurostat, 2009).

Thus, close scrutiny of the Economy-Wide Material Flow Accounts have allowed a number of key trends with regard to resource use, including biomass, metal ores, non-metallic minerals and fossil energy materials/carriers to be identified (EEA, 2010; Eurostat, 2005):

a) Europe has become more efficient in managing material resources: we create more wealth out of the resources we use. Yet in absolute figures, our consumption of materials continues to increase. Dematerialisation of the economy is therefore only relative and growth in resource productivity (RP) has not led to absolute decoupling of material use and economic growth.

b) Europe's economy is heavily dependent and increasingly so on imported natural resources — 2008 imports amounted to about 1,800 million tonnes (about 3.5 tonnes per person). This is most probably a conservative estimate as overall EU material demand might actually be higher than the domestic material consumption (DMC) indicator suggests once material flows associated with the production of traded communities are taken into account.

c) For the EU-27 Member States, the average annual use of material resources is some 16 tonnes per person; Domestic Material Consumption (DMC) in the EU amounted to 8.2 billion tons or 13 per cent of global materials extraction in 2007. In absolute

terms, DMC increased by about 8 per cent from 2000 to 2007. Per capita, DMC increased somewhat less, by about 5 per cent from 2000 to 2007. (Eurostat, 2011)

In addition, Eurostat now reports on various aspects of Member State resource use, most recently in communications on land use[40].The degree to which land is however considered a limited resource in this context may be further refined, especially if data on land is to be used in the resource efficiency context. The land surface embedded in a product (required to produce a given product) *per se* only provides a limited amount of information to decision-makers since what ultimately matters with regard to the environmental impacts (loss of ecosystem services or biodiversity) is the quality of the land disturbed to provide the resources required to produce a given product. Although not directly through the means of indicators, this is already recognised to a certain extent in policy-making such as in the pilot project described in Box 5.1 below.

Box 5.1 *Sustainability criteria for biomass in the Netherlands*

The Netherlands Standardisation Institute (NEN) is currently developing the NTA 8080 and 8081 standards to ensure the sustainable production of biomass along the whole supply chain and help companies and consumers adopt more sustainable consumption patterns. This voluntary instrument sets out specific criteria based on the minimum requirements for sustainable biomass production. A certification is expected to be enforced in 2011 and will aim to ensure the compliance of applicants to the certification. While it is currently only foreseen that the certification for complying with sustainability criteria is applied to companies, it might be worth investigating the possibility for biomass purchasing entities such as local authorities or companies which commit to purchasing solely certified biofuels to use only certified biomass.

Source: BIOIS (2010)

Eurostat's *Environmental Data Centre on Natural Resources and Products*[41] was established as part of the implementation of the existing EU Resource Thematic Strategy[42] to act as a gateway dedicated to the thematic area of natural resources and products. It provides a wide range of data as well as indicators for this thematic area. It includes indicators on, inter alia: transport and mobility, eating and drinking, housing and infrastructures, raw materials energy water, land, indicators for environmental Impacts.

[40] (2010 - http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/5-04102010-BP/EN/5-04102010-BP-EN.PDF), European environmental statistics and accounts (2010 - http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-32-10-283/EN/KS-32-10-283-EN.PDF), the Eurostat yearbook (2010 - http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-CD-10-220/EN/KS-CD-10-220-EN.PDF).

[41] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Environmental_Data_Centre_on_Natural_Resources_and_Products

[42] COM(2005) 670 final

As strongly suggested by the 2005 Resource Strategy and rightly pointed out in a recent (2010b) study by JRC, 'indicators supporting modern policies have to take the life cycle view of the links between consumption and production on the one hand, and resource use, environmental impacts and waste generation on the other. The life cycle perspective is also a global perspective. Therefore, it is not enough to consider domestic activities only. In the indicators' framework it means including environmental impacts occurring abroad, but driven by national or European demand for imported goods' (JRC, 2010b).

Three indicators have been increasingly used and referred to in the research community which could be a response to the most pressing needs for an improved use of indicators with regard to material resource use and efficiency. The further development of these three indicators, presented below, should be made a priority:

- **Environmentally Weighted Material Consumption (EMC):** this would allow to systematically identify the resources with the most environmentally harmful *impacts*, thereby moving away from the more limited and historic focus on quantity of resources measured in weight. In this context, it is worth mentioning the work JRC has recently done on an 'overall environmental impact indicator' (JRC, 2010b).

- **Total Material Requirement (TMR) and Total Material Consumption (TMC**), which answer complementary questions: TMR for the production side, and TMC for the consumption side. These two indicators could better inform the policy process than DMI and DMC because they reflect the resources embedded in traded goods and products, including hidden material flows such as water, energy, and waste in production. While TMR is an input indicator and highlights the production side, **TMC** measures the total primary material requirement associated with domestic consumption activities, and thus highlights the consumption side. Currently, there is much more country data on TMR than TMC.

- **Raw Material Consumption (RMC)**: currently being further developed by the Commission Services, this indicator is a step forward from DMI and DMC as, in addition to direct material flows, it accounts for the materials used to produce imported products as well. However, it is still limited to the actual materials used and therefore does not include hidden or indirect material requirement. It could therefore be seen as a step towards Raw Material Equivalent (RME), which does include these hidden and indirect elements.

Box 5.2 Short definitions

DMI: Direct Material Input. This indicator measures the direct input of materials for use in an economy, in other words, all materials which are of economic value and are used in production and consumption activities (excluding water flows). DMI can be calculated as domestic (used) extraction plus imports.

DMC: Direct Material Consumption. This indicator measures the total amount of material directly used in an economy, excluding hidden flows. DMC is calculated on the basis of DMI. DMC equals DMI minus exports (in economy – wide material flow accounting). The relation of domestic material consumption (DMC) to DMI indicates to what extent inputs of material resources are used for own domestic consumption or are exported to be consumed in other economies.

TMR: Total Material Requirement TMR is an economy-wide MFA indicator. While it may take a product-based approach to calculate the upstream material requirements or indirect flows associated with imports and exports (i.e. the total up-stream material inputs on the level of imported products or product groups) its purpose is to come up with a macro indicator on total material inputs to a national economy. It considers all used and unused extraction associated with the production of imported goods, measuring the total 'material base' of an economy. That is, the total primary resource requirements of the production activities. Adding these upstream flows converts imports into their 'primary resource extraction equivalent' (in economy-wide material flow accounting). Since all these material inputs will sooner or later be transformed into material outputs (i.e. emissions, waste) TMR also constitutes a proxy for potential future environmental pressures, on a life cycle-wide basis, to the domestic as well as foreign environment.

TMC: Total Material Consumption measures the total primary material requirement associated with domestic consumption activities. TMC is calculated on the basis of TMR. TMC equals Total Material Requirement minus exports and their hidden flows (in economy-wide material flow accounting). While DMC is already part of the EU Sustainable Development Indicator set, TMC is the targeted indicator for the future, once data is available.

RMC: Raw Material Consumption comprises used materials, equalling TMC (below) minus unused domestic extraction wherever it occurs (in the country doing the analysis or the originating country). This indicator involves use of data on used material extraction, and does not include unused extraction (the quality of the data on the latter is generally considered less robust).

RME: Raw Materials Equivalent is an indicator which highlights the upstream material requirements or indirect flows associated to imports and exports. This indicator can be produced both through input-output analysis to calculate RMEs of imported and exported products, or the use of life cycle assessment-oriented approaches.[43] It represents the raw material requirement of a product, expressing the total amount of raw material used directly and indirectly for manufacturing a product along the production chain. The RME is the used extraction that was needed to provide a product.

Source: OECD (2005), Best et al (2008), Eurostat, (2011a)

Footprint indicators, and in particular the Ecological Footprint, have frequently been mentioned as potential indicators for monitoring impacts associated with resource use, with potential for policy support and identification of targets and objectives.

[43] Several projects, including the RME/RMC project commissioned by EUROSTAT, apply a hybrid methodology, where some traded products are assessed with LCA, others with IOA.

The **Ecological Footprint** (EF) accounts for human demand on global biological resources and compares the level of consumption with available bioproductive land. It measures how much biologically productive land and water area is required to provide the resources consumed and absorb the wastes generated by human population. The calculations on which it is based basically translates one quantitative dimension of resource use (mass) into another quantitative dimension (land) (e.g. calculation of a virtual land area in order to translate carbon dioxide emissions). It provides and idea of just how much regenerative capacity of the biosphere is occupied by the resource consumption of the inhabitants of different countries (Wackernagel et al., 1999). It has been argued that the EF could inform policy goals including (OPEN:EU, 2010):

- Ensuring that human production and consumption activities are kept within the ecological boundaries of the planet
- Achieving a de-coupling between economic growth and resource use/ use of bio-capacity
- Reducing environmental impacts from resource use (except for monitoring abiotic resources and most emission sinks)

Its strength lies in its capacity to aggregate resource types rather than single-resource issues and to combine both resource input aspects and parts of the generated resource outputs (CO2 emissions). This results in an ability to easily communicate around the complex issue of overall impacts associated with consumption. This makes it a powerful tool for awareness raising about the off-site implications of everyday consumption and therefore good for problem recognition and communication on the need for policy action. It has however been argued that it is not the tool of choice for monitoring trends over time (there are no historic time series data for the EF so it is not possible to identify historical trends), that is it not robust enough (it relies too much on conversion factors and imputations of missing data) and that it could be more refined (OPEN:EU, 2010; Wesseling et al., 2007; Schaefer et al., 2006). It is also unlikely that the EF as an indicator will become policy relevant for specific sectoral policies. It must be pointed out, however, that these weaknesses do not automatically apply to other footprint indicators such as the Water Footprint (WF), which measures the use of freshwater resources, the Carbon Footprint (CF), which measures GHG emissions or the **actual land use of products** (Giljum et al., 2010). **Water and Carbon Footprints** only refer to one environmental category and can be applied at the country, sector, company, household and product level, whereas the EF aggregates different categories in one indicator and is applied at the country level (OPEN:EU, 2010). Therefore the WF and the CF may be considered more robust and potentially more useful for the policy-making and implementation than the EF.

This can lead to the conclusion that in combination, the Footprint indicators, if integrated in a modelling tool, may still help policy-makers identify appropriate policy interventions (OPEN:EU, 2010). Relying on the footprint family of indicators, the EU FP-7 OPEN:EU

research project[44] has designed the EUREAPA tool, which combines the data from national economic accounts and trade statistics with data from environmental and footprint accounts, thus allowing to identify differences in footprints across countries, from consumer and producer perspective, and also to identify footprint hot-spots associated with goods and services in order to help prioritise policy intervention. It could also be used to find countries with a lower consumption impact and identify the best practices that were used to create a lower impact.

Resource efficiency relevant indicators in the policy cycle

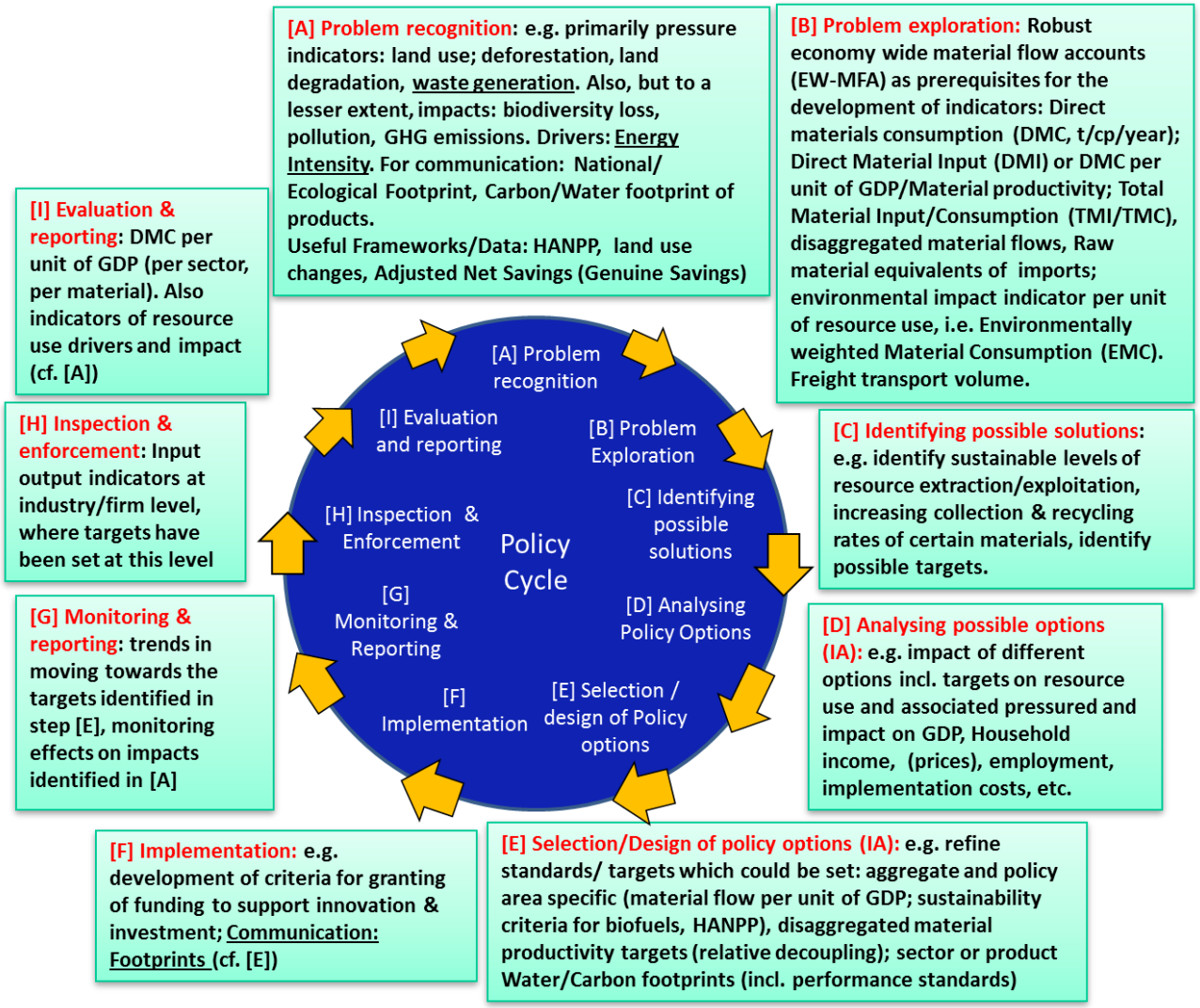
Figure 1 below provides an insight in the wide range of indicators which are part of the discussion on resource efficiency and are referred to at the various stages of the policy cycle. Resource use indicators are already used at EU level in the problem recognition and exploration stages, but given the under-developed state of EU natural resources policy, there is very little opportunity for their use in the rest of the policy cycle (see Figure 1 for a Figure of the policy cycle). Waste policy being most developed, can use some relevant indicators throughout the whole policy cycle, but most of the objectives of these policy mechanisms are collection of products for recycling or diversion of certain waste streams from landfill. These types of objectives do not necessarily link to the aggregated/composite indicators used already in natural resources.

As regards resource efficiency, the problem recognition and problem exploration stages have been the focal area of indicator development; the development of indicators for the stages of policy option design and implementation has so far proven more limited. Both indicators already in use (e.g. DMC) as indicators which policy-makers have identified as potentially useful but needing further development (e.g. TMR) have been included. The setting of targets is considered relevant at the stage of selection and design of policy options.

At least four indicators which have undergone an in-depth qualitative analysis in the context of the IN-STREAM project can be considered particularly relevant and are underlined in Figure 1 below. These are: Adjusted Net Savings (Genuine Savings), waste generation, GHG emissions and energy intensity.

[44] http://www.oneplaneteconomynetwork.org/

Figure 5.1 Current and future opportunities for using sustainability indicators in the resource efficiency policy cycle



Successful examples of the use of indicators

As stated earlier, natural resources policy is still relatively undeveloped. Some EU Member States have however been experimenting with the use of indicators to achieve a more sustainable use of resources. Non-state stakeholders have also promoted more sustainable resource use through the use of indicators in awareness raising activities, such as on the regular reporting of ecological footprints (a joint effort between the Global Footprint Network and WWF). Footprints have been prepared at country, region, and city levels in various countries including the EU-27, and have helped to highlight the EU's impacts on biocapacity.

The box below briefly presents remarkable Member State action in the field of indicators.

Box 5.3 Examples of Member State action in the field of indicators

Resource efficiency targets in Germany

In 2002 the Germany Sustainable Development Strategy set the target of doubling abiotic raw-material productivity in terms of kg primary raw material consumed per EUR GDP from 1994 to 2020. In the year 2008 the BMU published a Resource Efficiency Strategy in order to facilitate the achievement of this target. As of 2009, only 'fact-finding studies' and a dialogue process were already implemented. Among the other main tools described are a dynamic strengthening of existing and new limit values for products and technologies (as top-runner-strategy) (BMU homepage, 2009). The BMU 2008 Resource Efficiency Strategy includes two additional targets:

- Factor 4 (quadrupling resource productivity (Weizsäcker et al. 1997)) in the medium term (after 2020)
- Make the German economy the most resource efficient of all larger economies by 2020

The main limitation is that this only applies to abiotic resources and not biotic resources (e.g. biomass), which are considered to have a greater environmental.

Resource Efficiency Action Plan, Austria

Implementation of Austria's resource efficiency Action Plan has started in 2011. The Action Plan includes the target to stabilise and reduce resource consumption and to drastically increase resource efficiency to achieve absolute decoupling. The vision is 'Factor 4/10/X'.

Finland: Natural Resource Strategy

Finland's 2009 Natural Resource Strategy provides a 'vision of the Natural Resource Strategy for Finland for 2030' and promoted the concept of using resources intelligently by promoting four key strategic goals: 1) Finland becomes a thriving bioeconomy generating high added value, 2) it utilises and recycles material flows effectively, 3) that regional resource generate both national added value and local well-being and 4) that Finland takes initiatives and leads the way on natural resource issues. Most of these strategic goals will ultimately require measurement if progress is to be monitored.

Source:
http://www.eu-smr.eu/tssrm/docs/ms%20policies/Manstein%20Brussels%202010.06.20c.pdf
http://www.nachhaltigkeit.at/article/articleview/82975/1/25540
http://www.sitra.fi/julkaisut/muut/A%20Natural%20Resource%20Strategy%20for%20Finland.pdf

5.1.3 Future opportunities

There is clear recognition that the set of indicators used needs to be expanded if the EU's resource efficiency policy is to provide guidance to all economic actors and achieve real results in using resources more efficiently.

The Regulation on European Environmental Economic Accounts includes a module for economy-wide material flow accounts (EW-MFA) which encompasses data on:

- biomass (e.g. crops, crop residues, fodder crops and gazed biomass, wood, wild fish/aquatic plants/animals/hunting and gathering
- metal ores (e.g. iron, non-ferrous metal)
- non-metallic minerals (e.g. marble, granite, chemical and fertiliser minerals, sand and gravel, etc.)

- Fossil energy materials/carriers (e.g. coal and other solid energy materials/carriers, liquid and gaseous energy materials/carriers).

The data reported should apply to and distinguish domestic extraction from physical imports and exports, covering all imported or exported commodities in mass units, comprising goods at all stages of processing, from raw products to finished goods. Member States may be requested to include annual data from 2008 to the first reference year. This data is to a certain extent already available and forms the basis of indicators which are in part already use, in part still under development: DMI, DMC, TMR, TMC. The regular influx of this data can however be expected to strengthen efforts for tracing impacts of production in the country of origin, the development of more robust or new indicators and the setting of more relevant targets. These are very good starting points for specific resources, and could have the dual use of providing feedback on policies addressing specific resources while also feeding in to a higher-level basket of indicators (Fedrigo-Fazio, 2011). Some shortcomings have however already been noted, including that if focuses on the flows and neglects reporting on resource stocks and thus potentially fails to provide information relevant to respond to resource depletion. The opportunity for including additional modules in the Environmental accounts will need to be carefully considered.

It appears likely that the final Regulation will not include all the Accounts originally proposed by the European Parliament but will nevertheless request the Commission to consider including a proposal for the introduction of some additional modules in its report on the implementation of the Regulation to be prepared by the end of 2013. The additional modules to be considered for inclusion are:

- Environmental Protection Expenditure and Revenues (EPER)/Environmental Protection and Expenditure Accounts (EPEA)
- Environmental Goods and Services Sector (EGSS)
- Energy Accounts
- Environmentally Related Transfers (subsidies)
- Resource Use and Management Expenditure Accounts (RUMEA)
- Water Accounts (quantitative and qualitative)
- Waste Accounts
- Forest Accounts
- Ecosystem services Accounts
- Economy-Wide Material Stock Accounts (EW-MSA)
- measurement of unused excavated earthen materials (including soil)

Some of these modules are moving towards maturity. Ecosystem service accounts have seen a lot of attention recently (TEEB, 2011) and significant progress can be expected. In fact, the World Bank at the CBD COP-10 in Nagoya (October 2010) launched a partnership on environmental accounts with ten countries piloting natural capital/SEEA accounts, thus gaining practical experience in integrating natural capital into accounts and creating a basis for future uptake of SEEA and facilitating a move beyond GDP reliance (World Bank, 2011).

When assessing whether or not to add such additional modules to the accounts system the question of the policy-relevance of the indicators which could potentially be derived from the data collected will inevitably has to be raised. In the context of resource use, Giljum et al. (2011) consider a measurement system and derived set of resource use indicators relevant only as far as this enables monitoring and evaluating macro policies such as the implementation of a tax reform as well as more specific, sectoral policies related to resource use (e.g. energy, trade, etc.). It should therefore be possible to disaggregate indicators by economic branches. The Resource Efficiency Flagship Initiative has very helpfully highlighted the need for a coordinated approach across a range of policy fields. Additional to 'pure' natural resources policy, where a resource efficiency roadmap is to be prepared for mid-2011, other policy fields include agriculture, biodiversity, climate change, energy, transport, innovation, and industrial policies. There are therefore many opportunities to develop coordinated indicators across these policy fields, and to link these more strategically to economic indicators. On this latter point, it is important to note that resource efficiency has been included (at least notionally so far) in Member State reporting on the European Semester, a six-month period every year during which the Member States' budgetary and structural policies will be reviewed to detect any inconsistencies and emerging imbalances as a means of exiting from the financial crisis.[45]

Further indicators might become available as the European Environment Agency (EEA) advances in identifying indicators relevant for reporting on Sustainable Consumption and Production. The EEA and its European Topic Centre on Sustainable Production and Consumption (ETC-SCP) established in 2009 is developing an indicator set on sustainable consumption and production which is of high relevance for the thematic area of sustainable use of natural resources and products (ETC/SCP, 2010). Further work is currently under way on the indicator selection (best available) and assessment or development and research on single indicators or indices (best needed indicators) (ETC/SCP, 2009).

Attempts have been made to link quantitative data on the amounts of resources consumed with factors informing about the specific environmental harm of different types of materials, notably on the Environmentally-Weighted Material Consumption (EMC) (van der Voet et al., 2005, van der Voet et al. 2009). To date, the results have not been considered statistically robust enough to be further developed for official use, given the uncertainty in the weighting of impacts. However, the JRC is working on indicators on RME and on a modification of EMC, to address these gaps and to help make the necessary intermediate steps towards identifying impacts of natural resource use and actual levels used throughout the whole production chain. A basket-of-product indicator, reflecting the environmental impact and the resources used that are associated with the final consumption of an average citizen in the EU-27 over the entire life cycle of goods and services was being piloted in early 2011. In

[45] The aim of the European semester is to reinforce coordination while major budgetary decisions are still under preparation. It is one of the first initiatives to emerge from a task force chaired by the President of the European Council, Herman Van Rompuy, with a view to strengthening European provisions on economic governance.

early 2011, JRC was also piloting an eco-efficiency indicator for the total environmental impacts associated with EU consumption. The latter indicator is based on goods and services that are consumed in the EU territory in one years (plus imports, minus exports), with a methodology based on life-cycle inventory (LCI) data and international trade data. Work has also been done to identify the resources and products whose use may be most clearly linked to current environmental challenges (EEA, 2005; EC 2006; UNEP, 2010) yet the extent to which they have been used in policy-making has been very limited.

Methodology guides for environmental footprints for products and companies are being developed by DG Environment and the JRC (with methodologies different from the EF methodology of those used by the Global Footprint Network, relying more on an LCA-oriented approach with typical LCA impact categories). All footprints (ecological, carbon or water) have proved useful indicators for awareness raising and communication, for both policy-makers and the public. Water and carbon footprints could be used for the setting of standards or targets for some sectors as well as for consumer information through the labelling of products. Multi-issue environmental footprints may in some cases be useful tools more informative than single issue or impact tools focusing purely on carbon or water. In particular the Ecological Footprints at the national level has been very successful for communication and can be used effectively to communicate on the scale of the problem and the need to develop policy responses. The OPEN:EU[46] project, which was completed in 2011 meant to improve the policy application of footprint indicators to support Europe's transition to a one planet economy. It resulted in the development of a scenario-modelling and policy assessment tool – EUREAPA[47] – which relies on a footprint family of indicators and economic and trade data to communicate how environmental impacts might change through policy intervention induced changes in consumption and production. Developed both for policy-makers and civil society at large it may help to inform the evaluation or prioritisation of policy interventions.

In relation to the policy cycle, in many instances policy development is still in the problem recognition and problem exploration phases, which implies the need for aggregate indicators that measure and monitor macro-level issues such as consumption of main resource categories (for example in domestic material consumption, the importance here is to ensure that imports and exports are captured), land-use, water, and greenhouse gases/energy.

Ideally, indicators need to be linked in such a way that the above mentioned macro/ aggregate indicators should be made up of disaggregated indicators, for example on specific resources (e.g. critical raw materials, or biomass), and sectors (e.g. water use in agriculture), as well as the final destination of the resources (e.g. waste versus exported material in products). These would help to track the use of resources *through* the economy, and would lead naturally to sectors and eventually products using the resources. These would be useful

[46] http://www.oneplaneteconomynetwork.org/index.html

[47] http://www.oneplaneteconomynetwork.org/eureapa.html

for meso- or mid-level policies that would provide more specific orientation than the higher-level, macro policies.

Product-related indicators would form amongst the 'lowest' level of indicators, using LCA as a starting point where possible (these have not been done for all products with significant environmental impacts, so it may be that other indicators are already available even though not via an LCA). PRODCOM data could be used in some cases, but this would need further refinement as to category distinctions, notably in relation to the types of materials used (e.g. sustainably sourced, recycled, etc.).

Box 5.4 Product lifecycle indicators

The European Commission's in-house research facility, the Joint Research Centre (JRC), has developed new product lifecycle indicators to assess the progress of the EU-27 towards achieving a greener economy. The JRC's Institute for Environment and Sustainability (IES), which leads the European Platform on Life-Cycle Assessment, has developed three sets of indicators on resources, products and waste, which it hopes will serve the implementation of modern lifecycle-based environmental policies, like the EU's Sustainable Consumption and Production Action Plan. The indicators can be used to monitor the environmental impacts of relevant goods and services consumed by EU citizens as well as the transition towards more sustainable consumption behaviour.

Source: JRC IES (2010a)

Important lack of indicators in important impact areas will need continued attention, most notably in relation to toxicity of chemicals and in some local pollution impacts.

The construction of the indicator landscape would need to consider which indicators could be used at different levels – macro, meso, micro; which would be used in aggregated presentation at the macro level and then could be disaggregated at meso and micro levels; and which specific ones would be most useful on the micro level.

A number of on-going projects for the European Commission can also be expected to produce relevant recommendations before the end of the year[48]. Other important projects, which contribute to the further development of methodologies and data, are the FP7 EXIOPOL project (Tukker et al. 2009) and its successor, the CREEA project.

Finally, the potential relevance of the Index of Environmental Pressures and the World Bank's Adjusted Net Savings (Genuine Savings) could be further investigated.

Adjusted Net Savings (Genuine Savings) might be relevant in the resource efficiency discussion as far as they include a component recording trends in stocks of certain natural assets and provide the opportunity to investigate the links between different capital stocks

[48] http://seri.at/projects/ongoing-projects/assessment-of-resource-efficiency-indicators-and-targets-arit/

and monitor resource efficiency relevant information (i.e. energy depletion, mineral depletion, net forest depletion, damage from CO2 emissions, damage from PM emission).

The decision to develop the **Index of Environmental Pressures**[49] was taken by the Commission to overcome the historical tendency to address single issues in key areas, mostly focusing on carbon-related aspects, and sometimes extending this to other single issues such as water. The Index moves away from such a piecemeal approach towards a multi-criteria approach to impacts. One can expect that this index will be sensitive to improvements in resource efficiency as these should reflect in changes in a whole range of the component indicators (variables) on which the index rests. These are, in particular: domestic material extraction, fish catches outside safe biological limits, loss of soil quality reserves, waste generation and air pollution.

5.1.4 Policy recommendations

- A clearer political definition of 'resource efficient' is needed, so that an overarching political objective can be set. It also needs to be made operational for policy-making so that headline target/s can be developed more immediately, with sub-targets (on sectors, resources, etc.) to follow as needed. The success of an overarching political objective – such as returning to a one-planet resource consumption level by 2050 and the realisation of a range of underpinning concepts such as zero-waste, carbon and resource neutral, low impact, cradle-to-cradle will largely depend on adequate indicators underpinning the integration of natural resources aspects into the relevant policy fields

- More robust and comprehensive data provision is needed, to help build clearer policy objectives in the future. Regular and harmonised reporting by Member States on material flow accounts is fundamental because this is instrumental for the development of targets and indicators across policy areas. Reporting should however not solely focus on flows and data on resource stocks should also be collected, in particular where monitoring resource depletion is considered important. Progressing towards Integrated Environmental Economic Accounting (SEEA), bringing together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the environment would also bring about important benefits in developing a better understanding of the interactions between the economy, resource use and its impacts. Companies should similarly be required to report on their resource use.

[49] An environmental index that reflects environmental pressure and that can be used in policy debates alongside GDP and social indicators, to indicate whether progress is being made on environmental goals. The index will be a pressure index and the percentage by which the index decreases against a previous year could be interpreted as the 'growth rate of environmental protection'.

- Work is needed on resource/ecological thresholds to be linked to the targets/limits which should be set: In the medium- to longer-term, targets should be informed by resource and ecological thresholds (e.g. making greater use of marine trophic index and maximum sustainable yields for fisheries policy).

- Further development of an indicator identifying impacts of resource use, taking forward past work on an Environmentally Weighted Material Consumption (EMC) indicator (while already taking measures on identified priority materials). Serious consideration should be given to using the two indicators which are being piloted by the JRC (Environmental impacts indicators based on goods and services consumed, Basket-of-products indicators) as they seem to bear the potential to convey policy relevant information, in particular with regard to impacts.

- Continue to develop indicators that present actual consumption levels so that hidden and indirect flows can be captured. For overall resource use, move from domestic material consumption (DMC) total material requirement (TMR) and total material consumption (TMC)

- Targeted policies on specific resources or sectors may require special indicators: in many cases targeted policies on specific resources or sectors, with specific associated sets of indicators, will be needed

- In the absence of robust impact-related resource indicators:
    - focus mid-level policies addressing our main areas of environmental impacts, e.g. the consumption areas of food and drink, mobility, and housing.
    - Investigate the potential for using the Index of Environmental Pressures to identify potential correlations with trends in resource use and accounts
    - Investigate the potential for using Adjusted Net Savings (Genuine Savings) to monitor trends in stocks, investigate the links between different capital stocks and monitor resource efficiency relevant information (i.e. energy depletion, mineral depletion, net forest depletion, damage from CO2 emissions, damage from PM emission)

- Strengthen existing product (Ecodesign Directive, European Ecolabel and GPP) and waste policies, notably in the better integration of natural resources elements by further investigation of the linkages between these policies and resource use based on data available.

- Focus on better integration between, and coherence on, natural resource aspects in related policy areas: There is potential for an improved use of resource indicators and targets in overarching strategies promoting the integration of sustainable resource aspects in horizontal and sectoral policies (e.g. agriculture, biodiversity, climate change/energy, cohesion, fisheries, transport, etc.).

6 Green growth

'Distinctions must be kept in mind between quantity and quality of growth, between its costs and return, and between the short and the long term. Goals for more growth should specify more growth of what and for what.' (Simon Kuznets, 1962)

Key messages

Sustainability indicators for **Climate Change Policy**:

- In order to monitor the achievement of the targets set in the '20-20-20 climate and energy package' (COM(2008)16, 17 and 19), climate change relevant indicators have a crucial role to play. Specifically, **GHG emissions**, **energy intensity** and the **share of renewable energy consumption in total final energy consumption** are being closely monitored at European level. **Energy efficiency in buildings** is also an important indicator (both the specific efficiency value kWh/m^2 and the energy label with aggregate ratings), given the high potential of the building sector to deliver cost effective GHG mitigation.

- Opportunities for further **increasing accuracy and common methodology** in the measurement of energy intensity and of the share of energy from renewables exist and would be beneficial to better assess policy effectiveness.

- Consumption of renewable energy is not always easily measurable. A more systematic **breakdown by renewable energy source** (RES) would allow to better assess the overall sustainability of the energy mix – it will be useful to look at both RES contribution to energy production and consumption.

- Due to frequent **export and import of renewable energy**, there might be significant differences between production of renewable energy and the actual consumption by a country, so in some cases an adjustment to account for these flows might be necessary.

- Adopting a more detailed sectoral approach for the GHG emissions and energy intensity indicators would be beneficial for a more thorough assessment of climate change policies, their divers and possible opportunities for improvements.

- Climate change indicators are often linked to **trends of other indicators** (socio-economic, environmental, energy related indicators). This calls for a more explicit identification of these linkage and consideration of cross-policy impacts at the most relevant stages in the policy cycle. This appears particularly crucial during the analysis of different policy options, where the use of multiple indicators can allow for the

identification of relevant trade-offs and appropriate mitigating measures.

Sustainability indicators for **Cohesion Policy**:

- The focus of Cohesion Policy on economic development, and particularly growth and jobs, has arguably led to granting **more importance to the use of economic and employment indicators, at the expense of other sustainability indicators**, especially in the environmental domain.

- **GDP per capita is the only indicator used to determine the eligibility** of the different regions/Member States for EU Structural and Cohesion Funds and is mostly used to measure the achievement of the Policy's objectives. Its appropriateness to reflect new emerging challenges (e.g. climate change, energy security, etc.) and their impacts on regional economies, however, has increasingly been questioned.

- The **Community Strategic Guidelines on Cohesion call for the use of appropriate indicators on the state of the environment**. However, the proposed 'core' indicators are only of an indicative nature and Member States/regions are not legally bound to deploy them in the context of their programmes. Also, simple '**output' indicators** (e.g. a number of projects, etc.) are favoured, which are not very meaningful. The development of **'impact' indicators** has been difficult, as these are often perceived as less tangible.

- A great majority of environmental indicators currently adopted by Member States are **used at project level and primarily in the context of environmental interventions** – more particularly for reporting on the project's activity and output. EU funds programmes in which environmental indicators play a steering role are rather limited.

- In order to provide a more multi-faceted picture of regional development dynamics and trends, indicators such as the **Human Development Index (HDI), At risk-of-poverty rate after social transfers, Adjusted Net Savings (or Genuine Savings)** should be used alongside GDP.

- There might also be some scope for using the **composite Index for environmental pressures, the ecological footprint, ecosystem indicators** such as the moderation of extreme weather events and the total economic value of services provided by ecosystems, and using wider **natural capital accounts and/or economic and environmental accounts** and associated indicators.

- The **development of a coherent and robust system of sustainability indicators**, suited to account both for outcomes and results, is critical in the context of Cohesion Policy. These should be embedded at the level of policy, programme and project. There is also need for investment in indicators, data and tools to help regions to commit to objectives of *carbon neutrality* and *no net loss of biodiversity*. Similarly, there would be valuable benefits to help assess the state of natural capital and flow of ecosystem services from ecosystems to social and economic systems. This will require data, spatial

mapping and ideally also development of natural capital accounts for regions or other geographical levels (e.g. cities, river basins).

- This will require **additional administrative capacities and technical support systems** to guarantee the availability, collection, analysis and presentation of adequate data.

The notions of 'green innovation' and 'green growth' have captured policy makers' attention, and are endorsed in different strategies at EU and OECD level. However, as with other, comparably broad concepts – such as 'green investments' or 'clean technologies', it is near impossible to provide a clear and unequivocal definition of green growth or green innovation.

Green innovation is generally understood to include technological innovations in the areas such as renewable energies, energy efficiency, electric cars or fuel cells, as well as non-technological innovations.

Green growth promise to reconcile several policy objectives: to achieve sustainable economic growth, create high-quality jobs, to secure the competitive edge of EU businesses over competitors from other regions, and at the same time to achieve a drastic cut of CO2 emissions. And, last not least, it holds the promise of emerging stronger and greener from the economic crisis.

Green innovation is seen as an essential ingredient to achieving green growth. Through innovations in environmental industries such as renewable power and energy efficiency, it is expected that European businesses can secure technological leadership and a competitive edge in markets for green technologies and products, which are considered as future growth markets. Green innovation is therefore a crucial element to realize the EU's declared policy ambition of transforming Europe's economies into low-carbon economies.

The link between green innovations and the transformation to a low-carbon economy is explicit in the Europe 2020 strategy. This strategy for smart, sustainable and inclusive growth, which the European Council adopted on 17th June 2010, has three main goals: to boost job creation, economic growth, and competitiveness. This should be done under the umbrella of sustainable development and with the explicit goal to move toward a 'low-carbon economy'. The main vehicles to implement the EU 2020 strategy are seven 'flagship initiatives'. Of these, the initiative 'innovation union' makes the link between green innovation and the decarbonisation agenda. Two other initiatives – 'resource efficient Europe' and 'an industrial policy for the globalisation era' – are directly related to the low-carbon transition (see also chapter 5 on resource efficiency).

The notion of green innovation and its contribution to green growth is also very much enshrined in the forthcoming OECD Green Growth Strategy. The interim report of the Green Growth Strategy focused very strongly on the environmental policy and its potential impact on relative prices by reducing environmentally harmful subsidies and environmental taxes and trading permits.

In an effort to measure whether countries are moving toward green growth, the OECD has suggested to consider five broader groups of indicators:

(i) indicators reflecting the environmental efficiency of production as well as the absolute pressures associated with production,
(ii) indicators reflecting the environmental efficiency of consumption as well as the absolute environmental pressures associated with consumption
(iii) indicators describing the natural asset base of the economy,
(iv) indicators monitoring environmental quality of life, and
(v) indicators describing policy responses and instruments.[50]

The green growth agenda therefore established an important connection between different approaches to measuring economic, social and environmental progress, and between different types of alternative well-being indicators. Green growth strategies cannot aim to not only protect the environment, but also contribute to social and economic objectives by creating employment and strengthening the competitiveness of the European economy. In this sense, the notion of green growth is therefore quite closely linked to some interpretations of sustainable development.

The expression '**green economy'** is also frequently used in policy making. Recently, the European Commission unveiled a Communication on green economy and better governance in the context of the Rio+20 process (EC, 2011b). The Communication provides a broad definition of the green economy as an economy that generates growth, creates jobs and eradicates poverty by investing in and preserving the natural capital upon which the long-term survival of the planet depends. It also entails the proper valuation of natural capital and the revision of the way in which growth and progress are measured. Action is envisaged to be undertaken with regard to three policy dimensions of the transition towards the green economy including investing in sustainable management of key resources and natural capital (key areas of focus include water, energy, marine resources, agriculture, forests, ecosystems and biodiversity, waste management), establishing right market and regulatory conditions (a number of market-based and regulatory instruments are needed, large scale financial resources mobilised, skills and know-how developed, trade and development policies adjusted, and better use made of environmental accounting systems and robust indicators to measure progress beyond GDP) and improving governance and private sector involvement (governance for sustainable development needs to be reinforced and streamlined in international, regional, national and local structures while the participation of business also needs to be improved). While a consolidated position of the EU for the Rio+20 Summit is expected in November 2011, this blueprint shows the emerging Commission thinking behind the concept of the green economy, an integral part of which appears to be the pursuit of better ways to measure societal progress and human development.

[50] OECD 2010: Interim Report of the Green Growth Strategy: Implementing our commitment for a sustainable future, p. 60

As the terms green growth, green economy and green innovation are closely interlinked and sometimes overlapping, in this chapter the terms are often used interchangeably.

With regards to policy applications, the concept of green growth seems particularly relevant in the context of climate change policies - as they are key contributors to the transformation to a low carbon economy - and for Cohesion policies – given the great opportunity offered by EU funding to stimulate an environmentally and socially sustainable growth.

In the context of **climate change**, energy use and energy efficiency appear particularly crucial to achieve green growth. Energy efficiency policy is particularly broad in scope: it addresses buildings, products (e.g. EuP Directive), improvement of the efficiency in energy transformation and distribution and transport. There are clearly strong links with resource efficiency policies (see chapter 5 above), although, to avoid duplication, the issue is discussed only in this chapter.

In March 2007 the EU's leaders endorsed an integrated approach to climate and energy policy[51] that aims to combat climate change and increase the EU's energy security while strengthening its competitiveness. The commitment is to transform Europe into a highly energy-efficient, low carbon economy. A 20 per cent target was set both for the level of energy consumption to come from renewable resources and for the reduction in primary energy use, to be achieved by improving energy efficiency. On November 10, 2010 the European Commission presented its proposed new energy strategy[52] for the EU, laying down priorities in five broad areas, including achieving an energy efficient Europe and extending Europe's leadership in energy technology and innovation[53]. In addition, a Communication on infrastructure was published in November 2010. It seeks to curb Europe's energy consumption with financial incentives for energy efficiency in buildings and to integrate the European energy market. Furthermore, it proposes to ensure Europe's leadership on innovative energy technologies and address consumer issues, like making billing more transparent or making it easier to switch suppliers. In addition, the European Commission issued a policy paper in November 2010 in which it announced it will spend EUR 200bn in the next ten years to upgrade its outdated natural gas networks and energy grids and bring more renewable energy on-line.[54] Other legislation related to energy efficiency is also under development, e.g. a re-cast of the Energy labelling Directive

[51] EU climate and energy package: http://ec.europa.eu/clima/policies/brief/eu/package_en.htm

[52] COM(2010) 639 " Communication Energy 2020 – A strategy for competitive, sustainable and secure energy": http://ec.europa.eu/energy/strategies/2010/doc/com(2010)0639.pdf

[53] The five areas are as follows: (1) Achieving an energy efficient Europe; (2) Building a truly pan-European integrated energy market; (3) Empowering consumers and achieving the highest level of safety and security; (4) Extending Europe's leadership in energy technology and innovation; (5) Strengthening the external dimension of the EU energy market.

[54] Energy infrastructure: Commission proposes EU priority corridors for power grids and gas pipelines: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1512&format=PDF&aged=0&language=EN&guiLanguage=en

(framework directive) is expected to result in new rules for energy labelling of equipments and in an extension of the scope to all energy related products (accompanying EuP).

The challenge of establishing a more resource efficient economy appears to be particularly severe for the transport sector, which continues to rely almost entirely on oil, and has emitted 24 per cent more greenhouse gases in 2008 than in 1990. The 2001 EU White Paper set a target for the railway's share of the freight market at about 35 per cent by 2010. However, between 2000 and 2008 the share of rail freight transport decreased by more than 2 percentage points and in 2008 accounted for only around 17 per cent.[55] In 2007 the Commission adopted Communication (COM(2007) 19) outlining a new strategy to reach its long-established objective of limiting average CO2 emissions from new cars to 120 grams per km by 2012. On the production side, the strategy foresaw legislation to reduce CO2 emissions for new vehicles (passenger cars and light-commercial vehicles), efficiency requirements for car components, and the revision of the directive on cars' labelling. On the consumer side, the strategy included measures to promote the purchase of fuel efficient vehicles though improved consumer information and green taxation. In 2009 the Commission presented a strategy on sustainable transport[56], aiming at establishing a sustainable transport system. In April 2010, it published a Communication *A European strategy on clean and energy efficient vehicles*.[57] In its 2010 draft White Paper *A Single Transport Area - Smart Mobility for People and Businesses* the Commission takes on the challenge of promoting a deep transformation of transport, seeking independence from oil, the creation of more modern infrastructure and a different concept of mobility assisted by timely and complete information. This process will need to be steered by a set of clear targets and a reliable set of indicators covering the different areas in which transport systems need to see their performance improve (e.g. climate change emissions/measuring smart mobility). DG CLIMA is expected to publish a strategy on 'decarbonising' the transport sector soon. Among other measures, the Commission is aiming to stimulate public transport, transport modal shifts, the development of the infrastructure for railway etc.

EU Cohesion policy has a key role to play in supporting the transitions towards a green economy and innovation across European regions. This was acknowledged in the Fifth report on economic, social and territorial cohesion (Fifth Cohesion Report), adopted by the European Commission in November 2010, which set the strategic outlook for the post 2013 Cohesion Policy. In addition, the Commission adopted a Communication in February 2011 under the umbrella of the EU Resource Efficiency flagship initiative which puts forward a two-pillar strategy for the future Cohesion Policy to contribute to the sustainable growth

[55] European Commission, 2009 Environmental Policy Review: http://ec.europa.eu/environment/pdf/policy/EPR_2009.pdf

[56] COM(2009) 279 "A sustainable future for transport: Towards an integrated, technology- led and user friendly system":

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0279:FIN:EN:PDF

[57] Communication COM(2010)186 final:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0186:FIN:EN:PDF

objectives of the Europe 2020 Strategy. On the one hand, EU funds should invest more in sustainable growth specifically through actions for the transition towards *low carbon economy* (entailing stepping up investments in energy efficiency in buildings, renewable energy and clean transport systems); *ecosystem services* (by focusing activities on measures such as preserving natural capital, promoting risk prevention and climate change adaptation and enhancing green infrastructures); and *eco-innovation*, particularly through the promotion of new technologies and ICT systems. At the same time, it is proposed that the environmental performance of the entire Cohesion spending should be improved. This should be achieved through better integration of sustainability concerns throughout programme/project life-cycles and enhancing the use of environmental indicators for monitoring and evaluation. This means that the unfolding reform agenda on the future Cohesion Policy will have to tackle the issue of measuring progress to greener pathways of development and the question of developing adequate SD indicators resurfaces with new strength.[58]

In all these policies, it is apparent that achieving economic growth, social (e.g. employment) and environmental objectives is a real challenge. Environmental policies do affect the relative prices of goods and services, e.g. by restricting production patterns or by influencing the demand for certain goods. By changing the relative prices, environmental policies can improve or deter competitiveness, as well as trade and production patterns. Additionally, changes in relative prices can affect consumption and employment patterns, which in turn may affect social objectives like employment and income distribution. These trade-offs have become even more apparent with the recent financial crisis, when renewed preoccupation for sluggish economic growth and employment has sometimes raised doubts about whether resources will be sufficient to achieve the EU climate and environmental targets. Achieving green growth therefore requires, now more than ever, identifying these trade-offs and finding the right synergies across policies objectives in order to minimise them.

The use of indicators will arguably be crucial to measure the effect of policies in terms of environmental performance, economic growth and employment, and to help choosing the best policy mixes. This chapter will present concrete examples and recommendations for improving the indicator base supporting climate change and cohesion policy to reach a greener growth path.

It should be noted that other policies are also clearly important to achieve green growth. Some have been analysed under the other storylines (biodiversity and resources efficiency), while others could not be analysed within the scope and resources of this study (e.g. air pollution policy, water quality and quantity, adaptation policy etc.). Some of the lessons and recommendations drawn in this paper, however, can be useful also for the policies that could not be analysed.

[58] European Commission (2011) Regional Policy contributing to sustainable growth in Europe 2020, Communication from the Commission, COM(2011)17, 26.1.2011, Brussels

6.1 Climate change policy

6.1.1 Key policies where indicators have a role to play

To allow for a more targeted analysis of the use of climate related indicators in the context of this research note, the indicators selected as well as the analysed policies are primarily concerned with climate change mitigation. Although adaptation policies are key to achieving sustainability in the climate change policy area, an analysis of relevant indicators would have broadened the scope of this section too much. It must clearly be noted, however, that informed climate change adaptation strategies and policies will also require tailored indicators to be developed and used, in particular those concerned with the measurement of the vulnerability of regions to climate change.

Climate change mitigation as a policy area is characterized by the use of indicators from its early beginnings. At the Gothenburg European Council in 2001, the European Commission adopted the Sustainable Development Strategy (SDS), which was meant to be the environmental pillar of the Lisbon Strategy adopted in the year 2000. As such, it already referred to objectives in the area of climate change and sets up structural environmental indicators of relevance to climate change (Greenhouse gas emissions, Energy intensity of the economy, Volume of freight transport relative to GDP). These indicators play a key role in the evaluation and the monitoring of the environmental performance of sectors which are responsible for an important share of GHG emissions.

The 2009 Review of the EU SDS reiterated the EU commitment to take the lead in the fight against climate change and in promoting the development of a low-carbon economy. The 2009 review of the SDS as well as the Commission's Recovery Plan from November 2008 highlighted the opportunities offered by the economic stimulus and recovery packages adopted in response to the global financial crisis to include incentives and regulatory changes to shift towards a low-carbon economy. The approach is based on the view that innovative solutions are required to mobilise investments in energy, transport, industry and information and communication technologies, and that more focus is needed on energy efficiency policies.

Therefore, within the environmental pillar of sustainability, climate change concerns and policies arguably play a major role in EU's Sustainable Development Strategies. With the 2002 EU ratification of the Kyoto Protocol the EU has committed to an overall emission reduction of 8 per cent by 2012. The next EU long-term specific mitigation objective is set for the end of the century: to limit the potentially catastrophic and irreversible consequences of climate change by stabilizing temperature increase below 2°C. The European Council reaffirmed in February 2011 the EU objective of reducing greenhouse gas emissions by 80-95 per cent by 2050 compared to 1990 to achieve this 2 ºC objective.

Intermediate steps are a series of demanding climate and energy targets to be met by 2020. These are known as the '20-20-20 climate and energy package' (COM(2008)16, 17 and 19).

They consist of a reduction in EU greenhouse gas emissions of at least 20 per cent below 1990 levels; a 20 per cent share of total final EU energy consumption from renewable sources; a 20 per cent improvement in energy efficiency compared to the business as usual trends. More ambitious mitigation targets are also foreseen (emissions reduction to 30 per cent), provided that other major emitting countries in the developed and developing worlds commit to do their fair share under a global climate agreement.

In June 2011 the European Commission issued a proposal for a new Energy Efficiency Directive aimed at meeting the region's self-set target of a 20 per cent cut in energy consumption by 2020. The EU is lagging behind on its 2020 energy efficiency target, which requires a reduction of 368 million tons of oil equivalent (Mtoe). At the current rate of progress, the EU will only reach a 9 per cent saving in energy use by 2020 (EU, 2011). The 'EU Energy Efficiency Directive MEMO/11/440, 22 June 2011' proposes legally requiring member states to establish energy saving schemes to force energy suppliers to save 1.5 per cent a year through helping their customers replace inefficient heating systems or install double-glazing and insulation. Consumers would also be helped to cut their energy use through improved billing and metering. The public sector would be obliged to purchase energy efficient buildings, products and services to set an example and retrofit existing premises at a rate of at least 3 per cent a year. SMEs and larger industrial companies would also have to undertake energy audits, and identify areas for reduced energy consumption. The Directive proposes strengthening energy services markets. Under this arrangement, energy service companies (ESCOs) would cover the initial investment costs and recoup them through savings on energy bills.

For the monitoring of those various targets, climate change relevant indicators have a crucial role to play. These may relate to GHG emissions, energy efficiency/ intensity and share of renewable energy. Specifically at the European level, GHG emissions, energy efficiency and the share of renewable energy consumption over final consumption are being closely monitored. The key climate change indicators have an important role to play in evaluating a country's progress towards a low carbon economy and allow for inter country comparisons. In addition, in the long term, these indicators could support a peer pressure mechanism and lead Member States to improve their performance against the common objectives.

6.1.2 Use of sustainability indicators at present

From the wider range of environmental indicators which underwent a qualitative analysis in the context of the IN-STREAM project, only those considered most relevant for informing and monitoring climate policy results and formulation have been included for a further analysis. There is substantial overlap between the EU-SDS indicators for climate policy and the climate relevant indicators selected for a qualitative analysis as part of the IN-STREAM project (see IN-STREAM D2.2.).

Out of the list of IN-STREAM indicators, the most informative indicators for EU climate policy analysis and formulation are GHG emission (per capita/in levels), energy intensity and

renewable energy share. The table below shows that different variations of these indicators are included in some of the most important sustainable indicator listings.

Table 6.1 Climate change related indicators in key sustainable indicator lists

INDICATOR	EU SDS	UN CSD[59]	WDI[60]
GHG emission per capita	Growth rate GHG emission per capita	Greenhouse gases emissions in levels	Greenhouse gases emissions in levels (each gas separately)
Energy intensity	Energy intensity of the economy (energy/GDP)	Intensity in energy use expressed as ratio of total energy use to GDP	GDP per unit of energy use (PPP $ for kg of oil equivalent)
Renewable energy	Combustible renewables and waste (per cent of total energy)	Share of renewable energy sources in total energy use	Clean energy production (per cent of total energy use)

GHG emission reduction: There is a wide scientific consensus that emissions of greenhouse gases are responsible for global warming, with potentially dramatic economic, social and environmental consequences worldwide. GHG emissions are considered the most important structural indicator of climate change pressure as greenhouse gases contribute in varying degrees to global warming depending on their heat absorptive capacity and their lifetime in the atmosphere. Several countries used environmental indicators following the need to monitor the reaching of international and national policy targets. Topical examples are the annually updated and standardized inventories of GHG emissions that the UNFCCC requires since 1992 from Annex I countries. Emissions of the different gases are converted into CO2 equivalents, as determined by the Global Warming Potentials (GWP) described in the 1996 IPCC guidelines, and aggregated into one single figure. This composite indicator is thus able to summarize all the anthropogenic GHG covered by the Kyoto Protocol from 1990 (base year) onwards. By defining rules for GHG inventories and registries, the UNFCCC facilitated the subsequent use of GHG emissions levels indicator within the framework of the Kyoto Protocol as well as of Member States' national programs. The European Member States can evaluate their progress towards meeting required reductions, track the timeliness, consistency and comparability of relevant policies and are encouraged to report the presence of implementation problems. Within UNFCCC procedures parties are also requested to discuss the level of uncertainty associated with quantitative inventory data, at least qualitatively. The degree of confidence associated with CO2 data, in particular from fuel combustion, is high and the estimates are consistent across different authoritative sources.

[59] United Nations Commission on Sustainable Development

[60] World Banks' World Development Indicators

Energy intensity and energy efficiency: Reducing energy consumption and eliminating energy wastage is an important objective pursued by the European Union and it is the focus of the June 2011 'EU Energy Efficiency Directive MEMO/11/440, 22' (EU, 2011). Energy efficiency is a confusing term. Energy efficiency means the need to use less energy inputs while maintaining an equivalent level of economic activity or service (IPCC 2007). For a sector or a firm, increasing energy efficiency means a decrease in energy consumed per unit of goods or service produced ('technical energy efficiency'). For a country, energy efficiency measures reduce the amount of energy consumed per unit of output produced (IDDRI 2011). The climate change and energy package (COM(2008)16, 17 and 19) includes a 20 per cent target in increasing energy efficiency . It is therefore an 'absolute energy savings' target. An increase in the 'technical energy efficiency' (energy consumed per unit of goods or service produced) is not always sufficient to compensate for increased demand (rebound effect) and does therefore not lead automatically to meeting such a target (IDDRI 2011). The fact that the 'rebound effect' might undermine the effectiveness of the energy package in achieving its objective has not been sufficiently acknowledged to date, resulting in a slight mismatch between the overall target set and the means to achieve it.

Despite some shortcomings, the energy intensity is the indicator most often used as proxy for developments in energy efficiency. The two concepts not fully overlap however. While energy efficiency is a narrower concept that is more geared towards technology, energy intensity, i.e. how much energy is needed to produce one monetary unit of value (GDP or value added or sectoral production etc.), allows also the consideration of economic and behavioural aspects (OECD/IEA 2009). The introduction of a value added measure (GDP) is able to capture in a synthetic way where there is a 'decoupling' between final energy consumption and the economic performance of a country, sector or process. A shift towards 'decoupling' is generally seen as indicating a relative decrease in pressures on the environment from energy production and consumption. One of the shortcomings of systematically assuming this relationship is that the exact quantification of the reduction in environmental pressure (reduction in GHG emissions, waste, etc.) depends not only on the total amount of avoided energy consumption, but also on the characteristics of the consumed energy mix. Namely the indicator does not specify clean/fossil energy consumption quota which is a crucial element in judging environmental pressure. However, in the last decade, indicators that reflect changes in energy intensity have been used to monitor efficiency progress and identify market trends and improvement opportunities (OECD/IEA, 2009) and today are consolidated tools part of the climate change and energy policy process. Through the use of energy intensity indicators, governments are able to identify which industries need to be targeted for mitigation strategies. As a result, energy intensity indicators (particularly cross-country comparisons of them) are increasingly being touted as a very useful and necessary instrument for climate change negotiations and policy-making. Governments routinely produce documents displaying trends in these indicators, and cross-country comparisons of energy intensity abound in energy policy literature. Trends in energy intensity indicators increasingly serve not just as a monitoring tool, but as a basis for energy efficiency policies and regulations aimed at achieving greater energy savings. Reducing energy intensity and improving energy efficiency in industrial processes are important sustainable development objectives for countries all over the world. This is

primarily because improvements in intensities can imply a more effective utilization of (scarce) energy resources (i.e. through technological development) and result in the reduction of negative environmental impacts. A reduction of energy intensity in a specific geographical area can also be linked to shifts of the economy towards less resource intensive sectors and reflect a diversification of the economy.

Share of Renewable energy: This indicator is the ratio between energy consumption from a renewable source (or sources) and total energy consumption. Energy use is a key aspect of consumption and production. Dependence on non-renewable energy sources is unsustainable in the long term. Renewable sources, on the contrary, can supply energy continuously under sustainable management practices and their use is generally associated with a lesser amount of environmental pressures (or at least, a different mix of environmental pressures and impacts). Moreover, the promotion energy from renewables is often associated with a higher security in energy supplies. Therefore the ratio of renewable to non-renewable energy sources represents a measure of a country's energy sustainability. Binding national targets for renewable energy are set for the EU as a whole in the context of the 'climate and energy package' which will lift the average renewable share across the EU to 20 per cent by 2020 (more than doubling the 2006 level of 9.2 per cent). The national targets range from a renewable share of 10 per cent in Malta to 49 per cent in Sweden. The targets will contribute to decreasing the EU's dependence on imported energy and to reducing greenhouse gas emissions.

The three indicators described above are used across a wide range of policies and national programmes whose primary purpose is to mitigate climate change. A whole range of those policies particularly target sectors which are responsible for an important share of GHG emissions and/or an emissions reduction/energy savings can easily be achieved. This includes policies and measures pursuing the following objectives:

- improvements in energy efficiency in e.g. buildings, industry, household appliances (sustainable consumption and production);
- reduction of carbon dioxide emissions from new passenger cars (transport sector);
- abatement measures in manufacturing industry (industrial emissions);
- measures to reduce emissions from landfills (waste).
- increasing the use of renewable energy (wind, solar, biomass) and combined heat and power installations;

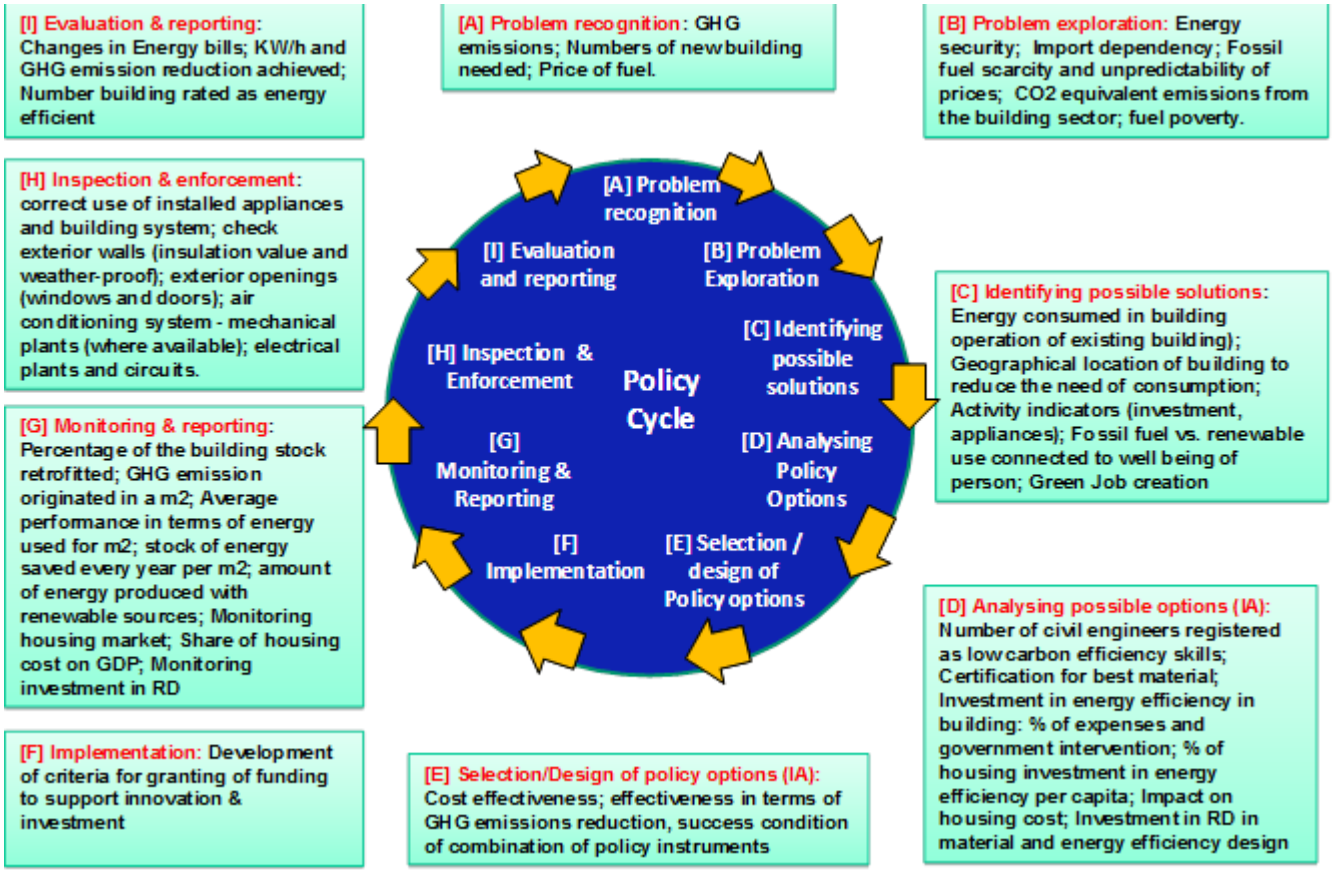
The last part of this section will illustrate how variations on the above presented three indicators may be used in a selected policy area of particular relevance to climate change mitigation. Choosing the area of policies to achieve energy efficiency in buildings, it is possible to document how variations of the three above mentioned indicators are used, alongside a range of other indicators, to achieve the mitigation of energy consumption (and CO2 emissions) associated with the **building** stock. This example was chosen because the building sector has more potential to deliver cost effective GHG mitigation than any other and increasing building energy efficiency can be achieved in the short-term. The building sector is a significant contributor to climate change as it consumes approximately 37 per

cent of global energy supply and it is responsible for 32 per cent of all CO2 emissions in 2004 (IPCC 2004). Energy consumption in both new and existing buildings could be cut by an estimated 30-50 per cent by 2020 through readily available technologies, design, equipment, management systems, and alternative generation solutions.

The directive on energy performance of buildings requires that new buildings built from 2021 onwards will have to be nearly zero-energy emissions. This process has already started, with many Member States implementing increasingly strict energy performance standards for buildings. On 4 February 2011, the European Council, confirmed that all Member States should include energy efficiency standards in public procurement for relevant public buildings and services. By the end of 2011, the Commission will present a Communication on 'Sustainable Construction' setting out a strategy on how to boost the competitiveness of this sector while improving its environmental and climate performance. Today, new buildings should be designed as intelligent low- or zero-energy buildings. The extra cost of this can be recovered through fuel savings. A greater challenge, however, is the refurbishment of the existing building stock, and in particular how to finance the necessary investments. In the 'EU Energy Efficiency Directive MEMO/11/440, 22 June 2011'7 the target as regards energy efficiency in public buildings is that as 'from 1 January 2014, 3 per cent of public buildings should be renovated each year, with the clear aim to save energy. In practice, this could mean that walls are insulated, double glazing windows are installed in kindergartens, schools or townhouses, roofs are redone and inefficient heating boilers replaced. In many cases a cost optimal renovation can bring up to 60 per cent energy savings. The benefit can be estimated to 6 Mtoe in 2020 would for illustration means that the construction of 17 coal power units or about 9 000 wind turbines would be avoided'.

Measures to improve further the energy performance of buildings should take into account climatic and local conditions as well as indoor climate environment and cost-effectiveness. These measures should not affect other requirements concerning buildings such as accessibility, safety and the intended use of the building. The figure below presents a schematic policy for energy efficiency in buildings policy process from the early stage of problem recognition to the later stages of implementation and evaluation.

Figure 6.1 Indicator use across the policy cycle of a policy supporting increased energy efficiency of building



6.1.3 Successful examples of the use of indicators

Important reductions in GHG emissions and improvements in energy efficiency as well as a significant increase in the share of energy of renewables are achievable at relatively low costs if an effective policy is put in place. Such a policy framework is likely to include efficient use of market-based instruments to develop a global price for GHG emissions, as well as measures for a better integration of climate change objectives in relevant policy areas such as energy, transport, building, agriculture or forestry, and speed up technological innovation and diffusion.

Several successful examples of the use of climate change related indicators or measures at national and international levels illustrate the various and sometimes innovative ways in which such indicators are used in order to inform progress towards reducing GHG emissions and mitigating climate change.

This section provides an insight into measures linked to the use of indicators to achieve a reduction in GHG emissions and emphasizes the wide range of actors at multiple scales of

governance which are called upon for improving the evidence base and the use of indicators in policy making the area of climate change.

Grenelle 2 in France: The Grenelle 2 law – '*National commitment for the environment'* - translates a range of nationwide sustainability targets to be achieved by 2050 set in the Grenelle 1 law[61] into concrete measures. Several provisions in the Grenelle 2 law deal with the improvement of the energy performance of buildings. They aim at improving the evaluation, verification and information regarding the energy performance of buildings, for example by requiring a certificate to confirm that the thermal regulations have been taken into account. The law also creates an obligation to carry out works to improve the energy performance of existing tertiary buildings, which will have to be carried out within eight years, starting in 2012. The standards are to be defined taking into account the original state of the building, the potential energy savings that can be realised and the volume of work that needs to be done to achieve these. These standards will either be indicated as a list of works that will have to be implemented or as a global energy performance that needs to be achieved.
Some of the measures relating to climate change in the Grenelle 2 law are also worth highlighting. The law foresees environmental labelling of products in view of increasing consumers' awareness of the environmental impact of products be tested. This created a framework for a large scale testing of environmental labelling in France. The labelling is not meant to be restricted to information on the carbon footprint (the amount of greenhouse gases emitted during a product's manufacture, packaging, and transport, i.e., lifecycle). Indeed, a range of environmental impacts throughout the life cycle are covered. The national experimentation for the environmental display on products will start in July 2011 with 168 companies and approximately 1000 products. The runtime of the experimentation is at least one year and participation is voluntary. Evaluation will start in summer 2012[62]. A report to be compiled after the trials will recommend whether they should be rolled out nationally and whether such labels should become mandatory.

Common carbon metric[63]: The common carbon metric was officially launched by COP15 in Copenhagen in December 2011. It is an initiative for Measuring Energy Use and Reporting Greenhouse Gas Emissions from Building Operations. Although all stages of a building's life-cycle (including construction and demolition) produce carbon emissions, the building's operational phase accounts for 80-90 per cent of emissions resulting from energy use mainly for heating, cooling, ventilation, lighting and appliances. Therefore, this is the stage of the building's life-cycle that is the focus of the Common Carbon Metric. A group of stakeholders, working in close cooperation[64], have developed a common measurement for GHG emissions from building operations that takes two complementary approaches; one assesses performance at the building level (bottom-up), and the other at the regional or national level

[61] which entered into force in August 2009

[62] http://www.developpement-durable.gouv.fr/Sustainable-Consumption.html

[63] http://www.sballiance.org/dldocuments/common-carbon-metric2009.pdf

[64] Cooperation among environmental building ratings organizations, local, regional, and national governments, research institutions, industry experts, and private sector stakeholders

(top-down). The actual reporting is done in weight of carbon dioxide equivalent (kgCO2e) emitted per square meter per year = kgCO2e/m2/year (by building type and by climate region). This carbon metric framework will set guidelines for a series of pilot projects (12 month length) assessing GHG emissions by building type and across climatic regions. The novelty of this approach is the focus on building's operational phase (instead on the entire life cycle) as it is the more pollutant and the more climatic region specific. This leads to a simplified assessment of buildings' carbon emission and the setting of climate related best practices. In addition, the project, launched under UNFCCC patronage, could anticipate a large scale application of this methodology.

Sustainable Tourism and Travel: It is important for different sectors of the economy to identify their contribution to climate change and identify how these can be addressed. Different sectors might propose indicators specific to their activities. The World Tourism Organisation (WTO, 2004) proposed using a selected range of indicators for sustainable tourism which covers all aspects of sustainable development[65]. These are, for example, consumption of fossil fuels by the tourism sector, total consumption of fossil fuels in the destination for tourist transportation, percentage of rooms with air conditioning and/or heating. The novelty in this case is not the adoption of new indicators, but their sectoral application, which highlight the contribution to climate change of sectors as tourism and travel (accounting for approximately 5 per cent of global carbon dioxide emissions). By 2035, under a 'business as usual' scenario, carbon dioxide emissions from global tourism are projected to increase by 130 per cent. Some measures are currently foreseen to better manage the rising emissions from this fast growing sector. Transport is the dominant contributor to GHG emissions from travel and tourism as it accounts for 40 per cent of the industry's CO2 emissions. The role of tourism in international aviation is increasingly recognised, in 2009, 52 per cent of travellers reached their destination by air (UNWTO, 2009) [66]. Including aviation, which is currently excluded from the Kyoto targets, in GHG reduction targets would be an important step to take. According to a 2009 paper from WTO, other measures to reduce GHG from the tourism sector that would require the use of indicators could include[67]:

- Reducing energy use through a shift in transport use or changing management practices. It would for instance be important to take into account how mountain

[65] WTO (2004), The Guidebook on Indicators of Sustainable Development for Tourism Destinations is the most comprehensive resource on this topic, the result of an extensive study on indicator initiatives worldwide, involving 62 experts from more than 20 countries. The publication describes over 40 major sustainability issues, ranging from the management of natural resources (waste, water, energy, etc.), to development control, satisfaction of tourists and host communities, preservation of cultural heritage, seasonality, economic leakages, or climate change, to mention just a few.

[66] UNWTO (2009) Tourism Highlights 2009 Edition http://www.unwto.org/facts/eng/pdf/highlights/UNWTO_Highlights09_en_LR.pdf.

[67] From Davos to Copenhagen and beyond: advancing tourism's response to climate change UNWTO Background Paper, 2009. http://www.unwto.org/pdf/From_Davos_to%20Copenhagen_beyond_UNWTOPaper_ElectronicVersion.pdf

destinations, for instance, need more energy for the heating of accommodation and facilities than sun or beach destinations.

- Improving energy efficiency for example through technological developments which will help reduce emissions, for example, improvements of aircraft performance to reduce fuel use and emissions from aviation
- Increasing the use of renewable energy, especially solar panels.
- Use of carbon compensation or offsetting - sequestering carbon through sinks (often forestry schemes)

Sustainable transport: Policy-makers depend on companies in different sectors of the economy for measurement and collection of information to have reliable estimates of the emissions associated with specific industrial and other economic activities. It is therefore worth highlighting when other motivations (competitiveness and strategic management) lead companies to partake and contribute to policy maker purposes. European railway companies have taken an interesting initiative in this respect rooted in the understanding that environment protection and indicators of environmental performance can became a strategic value added in brand promotion. The Institute for Energy and Environmental Research (IFEU), Heidelberg, and the Rail Management Consultants GmbH (RMCon), developed the objective EcoTransIT-Tool68 in order to quantify the emissions from freight transport and to highlight the differential in carbon content among railway, road and air transportation. This Project was initiated by five European railway companies in 2000- Railion AG, Schweizerische Bundesbahnen (SBB), Green Cargo AB, Trenitalia S.p.A, Société Nationale des Chemins de Fer Français (SNCF). New partners have subsequently joined. All project partners provide information for the database and constantly update the tool according to national policies and state-of-the-art information. EcoTransIT identifies the environmental impacts of freight transportation in terms of direct energy consumption and emissions during the operation of vehicles. Moreover, the calculation covers the indirect energy consumption and emissions related to production, transportation and the distribution of energy required for operating the vehicles.

The Global City: As highlighted by the Agenda 21, local authorities have an important role to play in mitigating climate change. As highlighted by a participant in one of the IN-STREAM workshops, there is a real need for better indicators for GHG emissions for regions and municipalities and the absence of good quality and timely data at the regional and municipal scales is a major obstacle to analysis. Work is needed to provide local authorities with a methodology to measure their GHG emissions. The Global City Indicators Program provides an established set of city indicators with a globally standardized methodology[69] that allows for global comparability of city performance towards sustainability across a wider range of

[68] http://www.ecotransit.org/

[69] Standardization of measurement of climate change indicators is a very sensitive issue. A common methodology of measurement permits the evaluation of the performances of a single city in achieving climate objectives and allows comparability among cities.

themes and knowledge sharing. A website[70] serves all cities that become members to measure and report on a core set of indicators through this web-based relational database. The Program is structured around 22 'themes' organized into two Categories that measure a range of city services and quality of life factors. The first category on city services includes some indicators which are relevant in the climate change and energy efficiency context (e.g. Total electrical use per capita (kilowatt/hour) and indicators on water and waste) also the quality of life themes includes more directly relevant indicators such as Greenhouse gas emissions measured in tonnes per capita. Moreover, other climate change indicators are under discussion for future implementation (Share of renewable energy use out of primary energy supply, Residential energy use per household by types of energy, Greenhouse gas emissions from municipal operation)

6.1.4 Future opportunities

This section describes how the well-established climate change indicators (presented above) can be further developed. Opportunities for further increasing accuracy and common methodology in measurement of energy intensity and share of energy from renewables exist. Although energy intensity is not a perfect indicator of energy efficiency, it can convey information on the general performance of a policy pursuing improvements in energy efficiency in respect to a baseline level. Thus one can expect that it will continue to be used in the future. Its explanatory power could however be increased proportionally with the sectoral detail with which it is applied. In doing so it can better highlight where key opportunities and drivers of changes in energy intensity are located. Indeed, if only aggregated, it fails to capture the role of the structure of the economy, both sectoral and geographical. It would be important to record the development of energy-intensity at least for the four main bundles of energy use: households, services, industry and transport.

In some countries, consumption of renewable energy might not always be easily measurable, since exports and imports of energy, and electricity in particular, are often given as totals, without a breakdown by the source. In such cases, the production of energy from renewable sources could be used as a first approximation. Nonetheless, due to potential export and import of renewable energy, there might be significant differences between production of renewable energy and the actual consumption by the country, so in some cases an adjustment to account for these flows might be necessary. The use of renewable energy indicator handles the problem of a common measurement issue, which is connected to the lack of a standardized methodology and the need to use conversion factors. That aspect should be further improved in order to reach a common measurement standard.

Another opportunity of improving the effectiveness of climate change indicators is connected to the sectoral approach to the GHG emissions and energy intensity indicators. Implementation of a sectoral approach would be beneficial for the analysis of the climate

[70] http://www.cityindicators.org/themes.aspx#Energy

change policy approach. Indeed, the increasing amount of information available on the greenhouse gas emissions by different sectors not only allows targeting priority sectors, it should also offer the possibility to establish sector specific baselines and targets for policy. The 'Roadmap for moving to a low carbon economy in 2050' initiates this process by identifying some of the key sectors for the emission reduction such as electricity, highlighting the importance of the share of low-carbon technologies in the electricity mix (renewables, fossil fuels with carbon capture and storage, and nuclear), and transport.

6.1.5 Policy recommendations

There are several areas in which the climate change indicators need to be strengthened to be more relevant and better inform policy-making. As regards climate change mitigation, the three indicators presented in this section are already used widely but opportunities lie in their further adaptation to the integration of climate change mitigation objectives across a wide range of relevant policy areas. Some efforts to make these indicators more informative and relevant are already in progress or under discussion. This section proposes a more holistic vision of 20-20-20 indicators, advising policy-makers to not assess policy effectiveness and country performance looking only at GHG emission, energy efficiency and renewable share indicators, but to consider also other environmental and economic indicators strictly connected.

Climate change indicators are often linked to trends of other indicators (socio-economic, environmental, energy related). These correlation need to be considered to fully grasp the implications of climate change targets and objectives in other environmental sectors and the economic and social pillars of sustainable development. Vice-versa, the implications of social and economic trends and targets as reflected in a number of indicators and objectives pursued in those areas have important implications in term of greenhouse gas emissions. This calls for a more explicit identification of these linkage and consideration of impacts of policy decisions in one area on the other areas at the most relevant stages in the policy cycle, in particular the analysis of different policy options, which allows the identification of the relevant trade-offs and mitigating measures to be taken, where needed.

Energy efficiency indicators are strongly related to GHG emission and economic growth, but it is not easy to disentangle the effects of the different components. These interactions may, indeed, influence the overall performance of a country in fulfilling policy target (as 20-20-20 policy), determining a divergent pattern of two or more indicators. For example, it may happens that increases in energy efficiency may not compensate for a rise in demand for goods and services, and that therefore improvements in energy efficiency do not automatically result in a fall in GHG emission. Additional indicators might be needed to capture and address this 'rebound effect'. In this respect, the evolution of the overall energy consumption and its growth should be considered in energy efficiency policies in order to better link them to GHG emissions targets.

Similarly, the GHG emissions indicator is also strongly dependent on sector specific characteristics of fuel mix. As each source has its specific carbon content, each sector a specific fuel mix and each country is more intensive in some sectors, a breakdown of the GHG emission indicator into sectoral and fuel specific emissions indicators can contribute to provide policy-makers with a relevant picture, thus allowing them to tailor more effective policies. Furthermore socio-economic indicators should be given more consideration when assessing the performance of GHG emission indicator: for example the effectiveness of Research and Development (R&D) policies in the field of emissions abatement should influence future perspective in achieving an emission target, even if present progress is not fully satisfactory.

Renewable energy indicator also presents strong ties with other areas which are not fully captured to date; for example it is worth noticing the link between one of primary sources of renewable energy (biomass) and GHG emission, due to deforestation and forest degradation (given forests' carbon sequestration potential). As an increasing use of this source of renewable energy, which is considered clean energy, could conflict with a GHG emission reduction path (by reducing the carbon capture ability of the forest stock), an indicator describing the mix of renewable sources would be helpful in highlighting the risk of unwanted side effects resulting from an unbalanced portfolio of renewable energy sources in the energy mix.

The multiple facets of climate change mitigation an adaptation sometimes make it difficult to identify real progress towards a GHG emissions reduction and a better evaluation of countries' climate change performance. As illustrated in this chapter, there are multiple ways in which this problem can be addressed and existing indicators in this policy area offer a good starting point for capturing the additional dimensions policy-makers need to consider if climate change policy is to deliver and climate change mitigation and adaptation targets are to be met in a 'smart' way.

6.2 Cohesion policy

6.2.1 Key policies where indicators have a role to play

The aim of EU Cohesion Policy historically has been to address regional disparities and bring structural change to the economies of less developed European regions. Throughout the years, however, the tendency has been to align Cohesion Policy to political high-level projects of the EU. For instance, the 2007-2013 Cohesion Policy is strongly aligned to the Lisbon Strategy for growth and jobs. The post-2013 Cohesion Policy is now to be brought in line with the objectives for 'smart, sustainable and inclusive growth', as enshrined in the new economic Strategy Europe 2020.

Box 6.1 Cohesion Policy for 2007-2013

Cohesion policy is an instrument of financial solidarity which aims to narrow the gap between EU's regions by providing them with funding for selected initiatives.

The policy covers all European regions, which fall in different categories (so-called objectives) depending mostly on their economic situation. In the current 2007–2013 funding period, EU cohesion policy consists of three objectives: Convergence, Regional competitiveness and employment, and European territorial cooperation. These replace the previous three objectives from 2000–2006, which were known as Objectives 1, 2 and 3.

The Convergence objective is available to the EU's poorest Member States and regions, with a GDP per capita below 75 per cent of the EU average. The Regional competitiveness and employment objective aims to strengthen regions' competitiveness and attractiveness and covers all regions outside the Convergence objective. The European Territorial Co-operation objective reinforces co-operation across national borders by promoting common solutions to a range of shared economic, social and environmental problems.

These objectives are implemented through three funding instruments: the European Regional Development Fund, the European Social Fund (so called Structural Funds) and the Cohesion Fund with a total budget of which is €347 billion for the 2007-2013 programming period.

For the first time from 2007, Community Strategic Guidelines on Cohesion stipulated in Council Decision 2006/702/EC seek to set overarching EU's priorities in line with the Lisbon Strategy aimed at boosting growth and jobs through improved competitiveness, in the Member States' National Strategic Reference Frameworks (NSRFs) and Operational Programmes (OPs). The Community Strategic Guidelines establish three main priorities:

- Improving the attractiveness of Member States, regions and cities by improving accessibility, ensuring adequate quality and level of services, and preserving the environment;
- Encouraging innovation, entrepreneurship and the growth of the knowledge economy by research and innovation capacities, including new information and communication technologies; and

- Creating more and better jobs by attracting more people into employment or entrepreneurial activity, improving adaptability of workers and enterprises and increasing investment in human capital.

The 2007-2013 Operational Programmes therefore include a wide range of interventions among which greatest priority was given to the development of transport infrastructure (24 per cent of the total funding allocated to EU12), research and development, innovation, SME development, entrepreneurship and business support, the enhancement of human capital, participation in the labour market, tackling poverty and social inclusion as well as support for the protection of the environment.

The focus of Cohesion Policy on economic development, and particularly growth and jobs, has arguably led to granting more importance to the development and refinement of indicators reflecting how the programmes and projects contribute to delivering economic and employment outcomes, possibly at the expense of the development and use of environmental indicators. Economic indicators (e.g. GDP, employment and competitiveness) are currently considered as the three top most influential indicators in the context of Cohesion Policy.[71] This means that indicators have traditionally been less concerned with informing policy-makers about the environmental impacts and potential trade-offs associated with the implementation of programmes and projects, focused on economic growth and competitiveness. Arguably, the integration of the environmental dimension, and the use of associated indicators, has primarily taken place where it could be linked to the overarching objective of economic development.

The Lisbon Treaty, which entered into force in 2009, introduced a new objective for territorial cohesion for the future Cohesion Policy. While the Commission is still in a process of defining territorial cohesion, it has been suggested that it offers a new opportunity to reinforce a holistic vision for territorial development that integrates economic, social and environmental objectives across European regions (EEA, 2010). Also, it can be seen as a way to gear the provision of funds to the different development needs and specific characteristics of European regions, which might go beyond pure growth and competitiveness objectives and require more integrated territorial approaches as part of their development pathways. The current EU commitments to a transition agenda towards low carbon and resource efficient economy as enshrined in the Europe 2020 Strategy and its respective Flagship Initiatives are likely to assert even more notably sustainability objectives in the future Cohesion Policy and with it also the need for better measurement of development and societal progress

The EU Budget Review was launched in 2007 with the aim to bring forward policy changes in different funding programmes, including EU Cohesion Policy, in terms of its objectives, financing priorities and overall performance. Cohesion Policy itself is currently under revision with the legislative proposals on the post-2013 Cohesion Policy expected to be presented by the European Commission in the autumn 2011 and adopted by the Council and Parliament

[71] Questionnaire, Representative of DG Regional Policy, European Commission

by the end of 2013. The issue of improving result-orientation and quality of spending is underlined in the conclusions of the Fifth Cohesion Report[72,73] and hence it is one of the central items on the reform agenda of the future Policy. EU Presidency conclusions of May 2011 also reiterate the Council's 'unanimous support and strong commitment that the effectiveness of Cohesion Policy can and should be further improved' and stress that one way to achieve this is through a more result-focused programming and increased emphasis on evaluation and indicators (EU Presidency, 2011). Therefore, the topic of indicators is essential for the currently unfolding political debates and provides an entry point for progressive ideas and proposals concerning the development and use of a set of core Sustainable Development (SD) indicators, focusing on its social, environmental and institutional dimensions.

6.2.2 Use of sustainability indicators at present

There are two levels at which indicators are applied in the context of EU Cohesion Policy:

1. GDP per capita as an indicator for determining the eligibility for funding of European regions and measuring progress towards economic and social cohesion (at the stage of ***strategic policy framework***);

GDP per capita is a key indicator that is used to determine the eligibility of the different regions/Member States for EU Structural and Cohesion Funds (i.e. it is formally used as a threshold indicator in EU Cohesion Policy) (EC, 2007). In other words, it constitutes the only indicator that underpins the definition of 'lagging behind' or 'less developed regions'. Under the current 2007-2013 Cohesion Policy funding, the Convergence objective is available only to NUTS 2 regions whose per capita GDP is less than 75 per cent of EU's average (in the case of the European Regional Development Funds (ERDF)) and regions whose per capita gross national income (GNI)[74] is below 90 per cent of EU's average (in the case of the Cohesion Fund).[75] Therefore, GDP per capita is the main proxy for distinguishing between regions in terms of regional convergence. Subsequently, since funding is distributed based on this principle, measuring the performance and achievements of the policy is often pre-occupied with looking at the increase in GDP per capita as a way to reflect on the progress in economic and social development.

[72] EC (2010) *EU Budget Review*. Communication from the Commission. (COM(2010)700), 19/10/2010, Brussels

[73] EC (2010) *Conclusions of the fifth report on economic, social and territorial cohesion: the future of cohesion policy*, Communication from the Commission, (COM(2010)642), 9/11/2010, Brussels

[74] Gross national income (GNI) differs from the GDP as it takes into account income received by resident units from abroad and discounts income created by production in a country but transferred to units residing abroad. In the past, it has been referred to as gross national product.

[75] See General Regulation 1083/2006/EC article 5

The appropriateness of using GDP to reflect new emerging challenges and their impacts on regional economies, however, has increasingly been questioned. It has been argued that while structural and cohesion funds have led to short-term improvements in economic growth they have not resolved overall regional disparities (EEC, 2008). For instance, the European Policy Centre stresses that if progress is measured based not only on GDP per capita growth but on social indicators such as the share of the population at risk of poverty, one would come to different results. They give an example of two Spanish regions (Ceuta and Extramadura) where in 2008, despite national GDP growth, around 40 per cent of the population was at risk of poverty (Dheret, 2011). Another study which analysed regional disparities against a range of structural indicators including economic, social, demographic, environmental and educational ones also reveals the existence of different regional development patterns than those based on GDP growth (EP, 2007).

At the stage of reporting and evaluation, economic and social indicators have been prevalent in the past. The 2010 Fifth Cohesion Report took for a first time stock of a wider range of progress indicators beyond the traditional GDP which covered *inter alia* innovation, demographic trends, environmental sustainability and climate change. Importantly, the report acknowledged that regions face 'striking regional disparities from differences in productivity, to infant mortality rates and vulnerability to climate change' and although many of these disparities have been shrinking, overall there 'remains a gap between the less developed and the highly developed EU regions' (EC, 2010). This means that wider societal issues, including to some extent environmental ones, are gaining more prominence in the way progress delivered through EU structural and cohesion funds is measured. Yet, this multi-dimensional approach to measuring progress needs to be further developed, refined and integrated, especially in relation to environmental indicators, more thoroughly throughout the entire Cohesion policy life cycle including both strategic and programme levels.

2. A set of economic, social and environmental indicators to measure progress towards respective objectives/targets (at the stage of ***programming and implementation***)

The development and use of indicators is not arranged in the overall regulatory framework of EU Cohesion Policy. The Community Strategic Guidelines on Cohesion call for the use of appropriate indicators on the state of the environment which should be used to inform the evaluation of needs and specific issues faced by regions underpinning the development of respective development strategies[76] but do not provide further guidance on the development and use of a more comprehensive indicators set. In more detail, indicators are arranged in two working documents developed by DG Regional Policy which establish a context-output-result-impact indicator framework (EC, 2006). Typical output indicators refer to 'number of projects' and result indicators relate to the effects of the intervention, for instance the number of households connected to water supply systems. Impact indicators are linked to longer term targets which an intervention is meant to contribute achieving. Member States are also

[76] Council Decision of 6 October 2006 on Community strategic guidelines on cohesion (2006/702/EC), Official Journal of the European Union, L 291/11, 21.10.2006

encouraged to report on 'core indicators' (these include output and result indicators) which were agreed between the Commission and Member States as a set of minimum reporting requirements linked to strategic objectives that could be aggregated at EU level (driven largely by the Lisbon agenda). An overview of 'core' environmental and social indicators proposed by the Commission and relevant to this paper is presented in Annex 1.

It must however be highlighted that the proposed 'core' indicators are only of an indicative nature and Member States/regions are not legally bound to deploy them in the context of their programmes. In addition to choosing to use the recommended core indicators, Member States / regions may also decide to develop their own indicator systems in a bottom up fashion under the shared management principle[77]. This means that the development of indicators would depend on national/regional political commitment and willingness to develop appropriate set of indicators as well as the domestic traditions, practices and knowledge base in this regard. This can be particularly challenging in the case of new Member States where monitoring of spending programmes have not been practiced prior to the EU funds programmes in 2004-2006 but also in old Member States where monitoring has been often restricted to taking into account the level of spending (EPRC, 2009).

The proposed 'core' indicators tend to favour simple 'output' indicators (e.g. a number of projects, etc.) which are not very meaningful. As a result if Member States / regions choose to solely adopt the proposed core indicators, they will have no real tool to measure actual policy results. Social indicators are limited only to job creation and social inclusion while environmental ones tend to focus on basic environmental infrastructure, GHG emissions/energy and risk prevention. There are no indicators concerning important environmental themes such as biodiversity and resource efficiency nor are there appropriate indicators to monitor environmental pressures stemming from non-environmental interventions such as transport and industrial development.

The development of indicators and evaluation systems has faced a number of challenges. While a number of environmental and social indicators are being developed by different Member States, the emphasis is still often on economic indicators (EPRC, 2009). According to a study, the development of 'impact' indicators linked to interventions meant to deliver results in the area of sustainable development has been difficult as these are often perceived as less tangible (Nordregio et al, 2009). The ex-post evaluation of the 2000-2006 found that there was little reliability regarding SD indicators due to issues such as low level of reporting, inadequate definitions, lack of time and resources and the inability to quantify qualitative changes (EPRC, 2009). In addition, in a whole range of cases, it has proven difficult to establish a correlation between a specific intervention supported by Cohesion Policy and quantifiable improvements in environmental quality.

[77] Shared management is a principle in Cohesion Policy where the European Commission has entrusted Member States with the implementation of EU Funds programmes and projects at national / regional levels.

The EEA finds two main obstacles to the effective use of indicators in the context of structural funds programmes. First, they argue that ex ante evaluations failed to set robust objectives and/or failed to use quantifiable indicators thereby limiting the usefulness of subsequent mid-term and ex post evaluations. In fact, the EEA finds that the lack of quantifiable data has been a distinct factor in limiting assessment of the (environmental) efficiency and effectiveness of Structural and Cohesion Fund interventions (EEA, 2008). Second barrier was found to be the lack of good quality consultation processes to establish relevant environmental indicators. This, according to them, includes consultation that does occur, but do not have clear mechanisms to incorporate the outcomes (EEA, 2008).

6.2.3 Successful examples of the use of indicators

Beyond the set of core indicators, proper monitoring and evaluation of SD impacts of EU Funds programmes and projects is in a process of maturation with a number of 'good practice' examples found in some Member States/regions (see Box 6.2 for an overview of emerging good practice examples). Yet, the development of such indicators is still the exception rather than the rule. A great majority of environmental indicators are used at project level and primarily in the context of environmental interventions – more particularly for reporting on the project's activity and output. EU funds programmes in which environmental indicators play a steering role are rather limited.

Box 6.2. Emerging good practices in applying environmental indicators in selected EU MS/regions

Energy
• Energy consumption of households (Basque Country)
• Capacity of renewable energy production (Northern Ireland)
Nature
• Ecosystem Services (TIDE INTERREG)
• Restoring water surface levels and species reintroduction (Lake Karla)
Waste and natural resources
• Levels of waste management, recycling and recovery (Northern Ireland)
• Waste reduction (South West England)
Sustainable consumption and production
• Number of enterprises with certified ISO 14001 or EMAS/ECOLABEL registrations (Spain, Italy, Germany, France)
• Green Public Procurement progress indicators (Basque Country)
• R&D activities to improve environmental sustainability of production processes (Piemonte)

Source: Hjerp et al (2011)

Some of the environmental indicators most commonly used include greenhouse gas emissions, number of passenger per transport mode, municipal waste generation per capita, PM emissions and emission of other main air pollutants, share of the different energy sources in overall energy consumption/production. Many 2007-2013 programmes included indicators designed to measure and monitor effects with regard to CO_2 emissions (13 out of

27 Member States) (Nordregio et al, 2009). However, it has been found that for some of these indicators, there are discrepancies in the measurement unit used in the different countries (e.g. some used CO_2 while others use 'CO_2 equivalent', which comes the global warming contributions across a range of greenhouse gases) and hence the data could not be compared nor aggregated at EU level. The set of core indicators would therefore benefit from establishing a common approach to a unified measurement system.

Furthermore, the EU Funds indicators/reporting system needs to accommodate the requirements of SEA reporting as set out in the SEA Directive 2001/42/EC (Article 10)[78]. It requires the monitoring of significant environmental effects of plans and programmes so that unforeseen adverse effects can be identified at an early stage and remedied accordingly. In Austria for example, a common SEA monitoring system has been developed in which every region is required to collect SEA monitoring data from their regional OPs and related projects and send this to a central database system. All regions use a common format for sending in the data to the central database based on a checklist which includes sections on air and climate change, and energy efficiency issues, and contains indicators and questions including on the use of fossil fuels, project impacts on energy efficiency etc. This SEA monitoring system is integrated in the overall Cohesion Policy monitoring system and once fully operational, should provide the basis for collecting and comparing data related to the climate change impacts of OPs and different projects (ENEA-REC). It must be pointed out, however, that despite the requirements of the SEA Directive and this good practice example, there is little evidence indicating a more general move towards making the SEA reporting an integral part of the general EU funds indicator and monitoring systems across Member States/regions.

Some countries have further enhanced the application of environmental indicators as a support system for measuring and rewarding better performance of EU funds programmes. The *Piemonte* Region has developed an incentive system aimed to stimulate and reward the achievement of better environmental results in non-environmental interventions. The system envisions the provision of additional funds to SMEs that succeed to demonstrate, using a selected set of indicators, that the innovation projects for which they have applied for financing have resulted in a positive environmental impact.

6.2.4 Future opportunities

The architecture of the post-2013 EU Cohesion Policy as set out in the Conclusions of the Fifth Cohesion Report (EC, 2010) indicates a number of opportunities for using a wider range of indicators along the policy cycle of Cohesion Policy. At strategic policy level, the new objective for *territorial cohesion* has a strong environmental dimension and could result

[78] Article 10 requires the monitoring of plans and programmes. In developing indicator systems for Structural Funds programmes Member States should take a decision if and how the monitoring as required under the SEA Directive and the monitoring system of the Structural Funds programme as such should be integrated or complement each other

in environmental sustainability being given more weight in the future Cohesion Policy (EC, 2010). This means that there is scope for developing a variety of indicators alongside the traditional GDP per capita in order to measure more adequately progress towards this new objective of the future policy. Other opportunities will arise at a programming stage where the *development and investment partnership contracts*, provide further scope for using SD indicators: in those contracts, the SD indicators could for example be linked to negotiated objectives, priority interventions and conditionality between the Commission and Member States/regions.

There is some scope for using the composite Index for environmental pressures in relation to Cohesion Policy, although it is likely that limited data availability at regional level could limit its potential for informing on the pressures associated with more specific programmes. In addition, the index, as well as the ecological footprint could be suitable indicators for communicating on sustainability related issues in Cohesion Policy. Among the ecosystem indicators which could be of use in Cohesion policy but have so far not been sufficiently considered are those related to natural hazards regulation and the total economic value of services provided by ecosystems (e.g. for cities). There is a need for indicators allowing for a reporting on the level of cost recovery of natural resource use. Hence, there is scope for using wider natural capital accounts and/or economic and environmental accounts and associated indicators in Cohesion Policy (Gerdes et al., 2011).

SIOOI model and policy cycle

As highlighted above, the development of a coherent and robust system of SD indicators, suited to account both for outcomes and results, is critical in the context of Cohesion Policy. In this regard, an adapted version of the classical **D** (driver) - **P** (pressure) – **S** (state) – **I** (impact) – **R** (response) model appears to be particularly useful in determining cause-and-effect relationships and better identifying the impacts/effects of human activities on the environment and vice versa. The authors of this report propose a version of the DPSIR model adapted to Cohesion Policy, which would include the following types of indicators:

1) **State** – used to establish a baseline of socio-economic and environmental situation;
2) **Input** – the share of funds allocated for different measures of intervention;
3) **Output** - Specific intervention (e.g. number of projects supporting Natura 2000);
4) **Outcome** - Direct and immediate effect from the intervention (e.g. reduced energy use); and
5) **Impact** - Long-term effects for the society as whole. These are essentially linked to the state indicators by indicating a change in baseline.

EU Cohesion Policy promotes interventions in a number of different policy areas (e.g. competitiveness and entrepreneurship, infrastructure, environment, employment, etc.). This means that it will be difficult in the scope of this paper to propose a comprehensive set of indicators that will reflect sufficiently the diversity of actions and associated outcomes and impacts. Instead, this report endorses the SIOOI model as an overarching framework and provides examples of state-input-output-outcome-impact indicators that can be applied at

different stages of the Cohesion Policy cycle. The different 'stages' of the policy cycle of EU Cohesion Policy, as identified by the authors of this report, entail:

1) **Strategic policy framework** (e.g. the regulatory basis for EU Cohesion Policy as determined by the EU funds regulations and the Common Strategic Guidelines, which set out general provisions for eligibility for funding, monitoring and reporting);

2) **Programming** (e.g. the development of National Strategic Referential Frameworks (NSRF) and Operational programmes (OPs), which establish national/regional strategic and operational objectives, priority interventions, allocations of funds. At this stage important procedural instruments are also deployed which can use or propose indicators relevant for the NSRF and OPs [e.g. ex-ante evaluation and SEA]);

3) **Implementation** (e.g. project selection, development and implementation where specific provisions at project level are applied including project indicators. These however of less interest for the purpose of this project and less attention will be paid to them);

4) **Monitoring and reporting** (e.g. annual and strategic reports where account is taken with regard to progress made in terms of specific outputs of the planned interventions but also more generic types of results); and

5) **Evaluation** (e.g. on-going/mid-term and ex-post evaluation which should measure long-term societal effects and impacts in terms of well-being, quality of life, environmental performance, etc.).

EU Cohesion Policy is implemented through funding programmes and investment projects, which means that indicators need to be ideally embedded at the level of a policy, programme and project. As addressing all these different levels would however go beyond the scope of this paper, it will focus on the strategic policy, programming and reporting stages, which are arguably the three most relevant stages of the policy cycle for Cohesion Policy. The issue of identifying appropriate indicators at project level could be explored in a separate consecutive paper.

IN-STREAM indicators and Cohesion Policy

A number of IN-STREAM indicators are considered relevant for Cohesion Policy. While some could be used at the more strategic 'policy framework' stage in relation to policy objectives and targets, the stage of 'Monitoring and reporting' and 'Evaluation' also offers scope for their use in view of measuring achievements of the Policy. These could be used complementarily to GDP per capita, which currently is the main headline indicator, in order to provide a more multi-faceted picture of regional development dynamics and trends. These include for example:

- Human Development Index (HD)I);

- At risk-of-poverty rate after social transfers;
- Adjusted net savings (Genuine Savings).

These two former can complement GDP by providing a social perspective (beyond employment) to regional development trends in countries/regions (see Appendix II for a more detailed presentation of these two indicators). The latter expands the notion of 'assets' by including natural resources and human capital, and by measuring the true rate of savings in an economy after taking into account investments in human capital, depletion of natural resources and damage caused by pollution, allows putting an emphasis on both the (social and environmental) sustainability of the economic development. It measures the sustainability of investment policies in particular, by allowing to test whether rents from natural resources and changes human capital are balanced by net saving in man-made capital (Gerdes et al., 2011).

The way in which it suggests links between different capital stocks emphasizes the need to ensure that growth in the short term does not come at the expense of future opportunities for growth. While the Adjusted net savings (Genuine Savings) indicator does also address some aspects of the environmental dimension (i.e. energy depletion, mineral depletion, net forest depletion, damage from CO2 emissions, damage from PM emission) it falls short of fully capturing all elements constituting a region's natural assets. In order to adequately and fully account for the environmental angle one has to look beyond the IN-STREAM indicators.

Further to these more strategic indicators, other IN-STREAM indicators could be more operational (i.e. applied at a programming and reporting stages of the policy cycle), which can be applied by Member States/regions in their partnership contracts, Operational Programmes, annual implementation and strategic reports. These include:

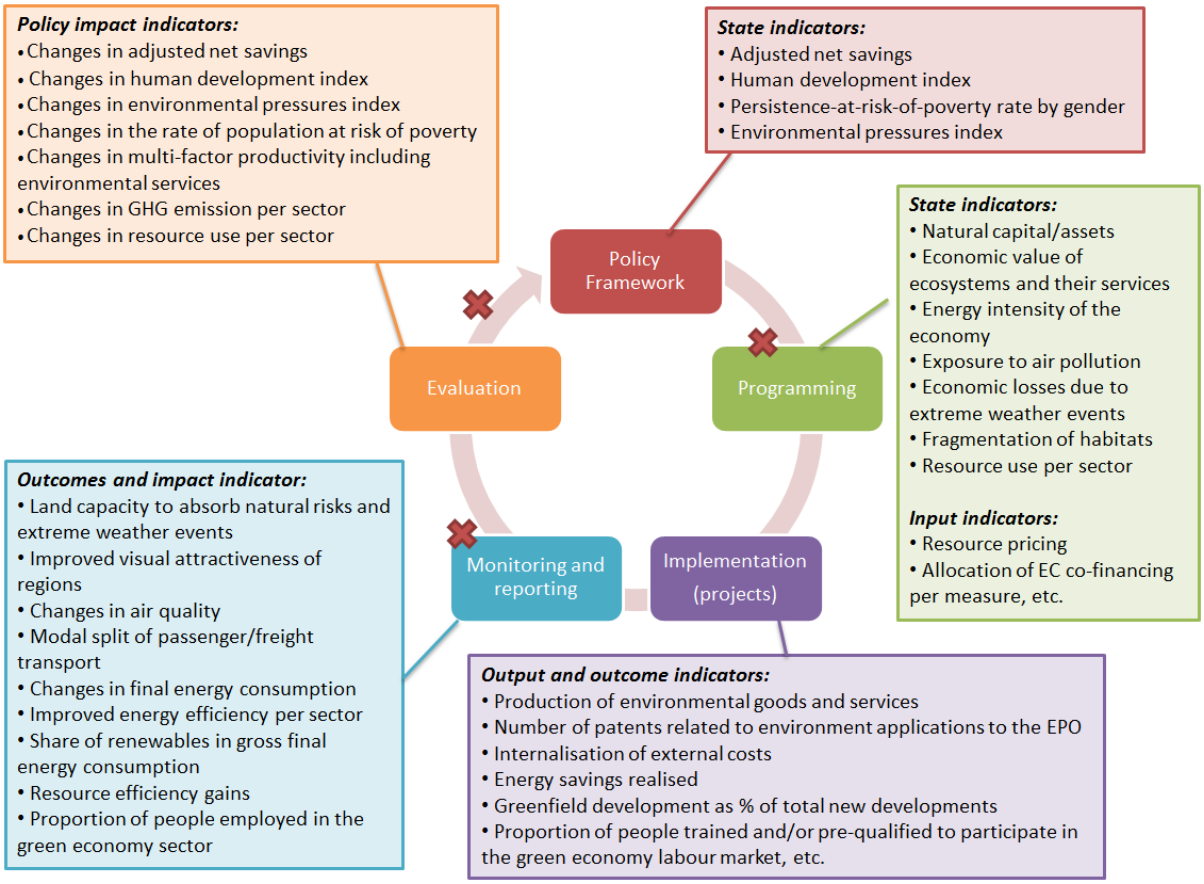
- Basket of resource indicators (EF, EMC, HANPP, LEP);
- Per capita waste generation and energy from waste;
- GHG emissions;
- GHG intensity of GDP;
- Volume of freight transport relative to GDP;
- Favourable Conservation Status (FCS);
- Energy Intensity of GDP;
- Value of built capital; and
- Direct external costs from pollution.

The IN-STREAM indicators however relate to a small fraction of the interventions currently supported in Cohesion Policy and therefore are insufficient if the task is to develop a more comprehensive set of SD indicators. This means that a wider set of indicators need to be reviewed and assessed in terms of their suitability for the future EU Cohesion Policy. The authors have reviewed a number of SD indicators (see Appendix II) which could be used effectively in the future Cohesion Policy using the SIOOI model.

SD indicators for the future Cohesion Policy

Based on Appendix II, we discuss a set of exemplar indicators which can be promoted at different stages of the Cohesion Policy cycle. Further discussion takes place with relation to the three most important stages – strategic policy framework, programming and reporting. Some of these indicators could also be used as 'core indicators' (see section 6.2.2) which managing authorities may decide to introduce at the programming stage and report progress on these to the European Commission at the stage of monitoring and reporting. The proposed indicators can be useful in the context of transitions towards the green economy as they emphasize the interlinkages, synergies and trade-offs between the economic, social and environmental dimensions of EU Cohesion Policy.

Figure 6.2. Selected SD indicators along the EU Cohesion Policy cycle



The **strategic policy framework** for Cohesion Policy is developed and agreed upon at EU level. In order to design a result-oriented future Cohesion Policy, it is essential to set out a basket of SD indicators, following the SIOOI model, which can be then be used at the relevant policy stages as demonstrated in Figure 6.2. At this strategic stage, there is a clear need to establish the baseline conditions (state indicators) against which to measure outcomes from the Cohesion Policy interventions at EU level and also overall impacts for

economic, social and territorial cohesion. This means that there is a strong link between the state indicators against which respective outcome and impact indicators should be applied at the level of reporting and evaluation. For example, it is important to consider the introduction of complementary indicators to the GDP, which can show trends and developments in social/human and environmental conditions/objectives. Therefore, at EU level there could be scope for proposing indicators such as the **human development index, net adjusted savings and the index on environmental pressures** as possible core indicators complementary to the GDP measuring the impact of the future Cohesion Policy at this stage of the policy cycle.

The programming stage is taking place at the level of Member State/region in consultation with the European Commission. In the next programming period post-2013, special development and investment **partnership contracts** are to be developed replacing the current national strategic referential frameworks while the **Operational Programmes** (OPs) are to be retained. Arguably, at the programming stage it is important that in parallel to the development of specific objectives, priority interventions, targets and conditionality, corresponding SD indicators are also developed. At this stage, the full model of state-input-output-outcome-impact indicators can be designed so as to be embedded into the Partnership contracts and Operational programmes at national/regional level of governance. Given the wide range of interventions co-financed under the different OPs, a comprehensive basket of economic, social, environmental and institutional indicators should be developed at this stage. Such indicators could include risk of economic losses due to extreme weather events (state indicator), number of green jobs created (output), GHG emission generated by new transport developments (impact indicator), etc. (see figure 6.2).

The current thinking of the Commission is to introduce the so called ***ex-ante conditionality*** in the future Cohesion Policy (e.g. availability of sectoral management plans to inform investment projects or sufficient administrative capacity to perform SEA/EIA). Introducing conditionality in this way would require managing authorities to apply specific state indicators (including ones regarding institutional capacities) prior to the OP preparations and respective negotiations with the Commission. Conditionality and respective indicators however could be developed in other ways as well. One approach could be similar to the NECATER tool used in France where all regional OPs are subject to GHG indicator against which the whole planned portfolio of investments is screened ex-ante. The aim is that the total investments should be carbon neutral meaning that some projects which induce GHG emissions are allowed only if there are projects which will result in GHG saved. This way, the indicator for GHG emissions, becomes an important tool for the **selection of projects** at an ex ante stage. A more ambitious version of this is to ensure that OP programmes go beyond carbon neutrality and investment is allowed only if it reduces emissions.

While there is little scope for asserting detailed provisions concerning long and complex indicator sets in the Regulation itself, there is scope for explicitly stipulating requirements for the development and use of SD indicators complementary to the GDP within **ex-ante, on-going and ex-post evaluations but also in annual and strategic reports**. The Cohesion reports prepared by the Commission every three years should be explicitly required to report

on progress towards the achievement of economic, social and territorial cohesion based on a basket of economic, social, environmental and institutional indicators. The on-going evaluations, which replaced the previous mid-term evaluations, have become critical not only in view of evaluating the first outcomes of the implementation of the current EU funds programmes but also in view of providing valuable input into the programming of the post-2013 programming period.

While the on-going evaluations offer some flexibility in terms of their scope and timing depending on domestic circumstances and the actual need for an assessment, they could constitute a challenge to new Member States, which rarely possess in-house expertise and culture on policy evaluations. For example, Estonia and Bulgaria are planning to undertake mid-term evaluations (Applica and Isomeric Europa, 2010) as there is more clarity on what these should be. **Further guidelines and instructions** from the Commission would be critical in order to aid the managing authorities in these countries. Particular guidance would be useful in terms of the environmental dimensions of such evaluations. In the case of Member States, this lack of experience and knowledge on how to carry further the evaluations will inevitably result in delays and might affect the overall management of the funds. The European Commission could also carry out **thematic and strategic evaluations** at any time of the policy cycle with the aim to improve the understanding of concrete issues and drivers for these within Cohesion Policy, hence strengthening the knowledge base for policy-making and spur learning. Such evaluations, with a focus on the interlinkages between Cohesion Policy, sustainable development and green economy could be extremely useful tools during the preparations of the policy framework for the future policy but also during the implementation of operational programmes.

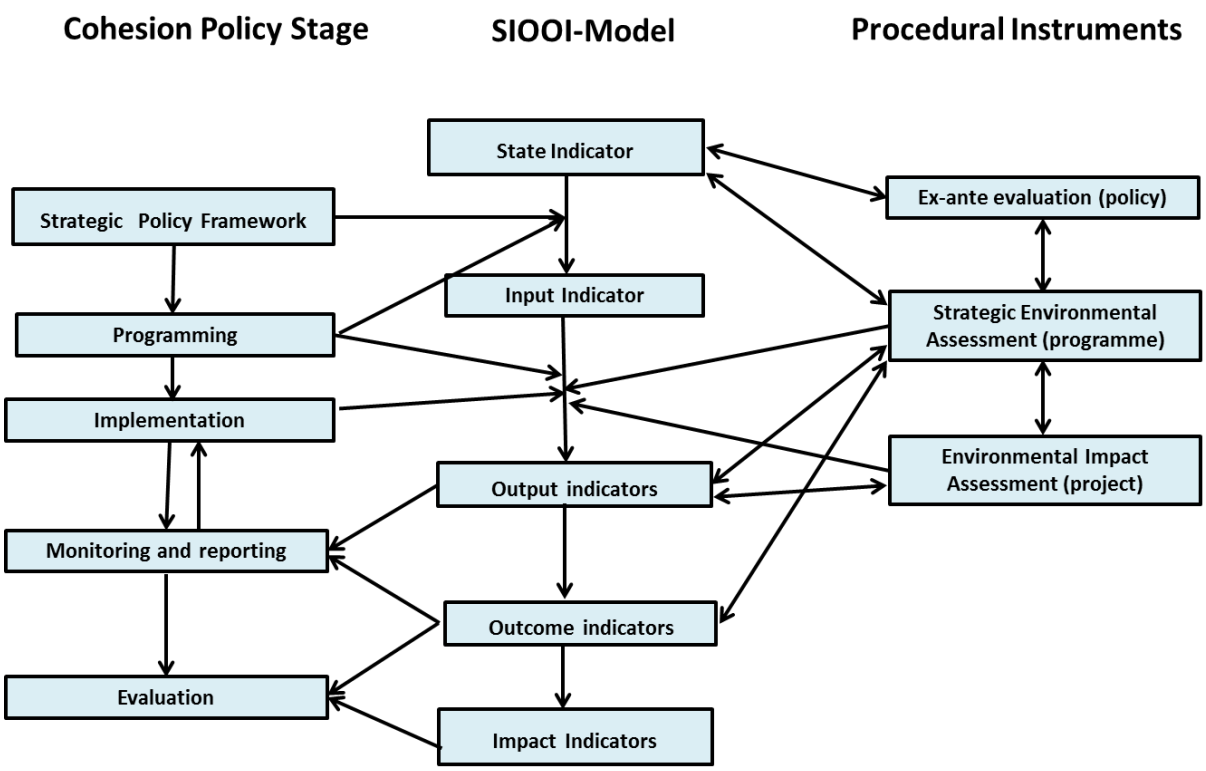
The new Regulation can prescribe an **incentive structure** that could be used in the future to tie the performance of the funds to the achievement of concrete EU/national environmental objectives/targets. The performance reserve can be set out in the EU Funds Regulation in a way that it stimulates and rewards outstanding performance beyond compliance with EU environmental legislation and related targets (e.g. green champions, front runners). To measure and reward performance, a set of outcome SD / environmental indicators would be critical. The details of this can be arranged in the specific EU funds guidelines.

Relationship between Indicators and procedural tools

From the above it is clear that Cohesion Policy is a multifaceted and complex area where the use of indicators provides a number of challenges. The list of indicators listed in Annex II gives an indication of the large number of indicators that could be used in Cohesion Policy as a consequence of the number of sectors covered. However, this is also true in strategic decision-making for many other policy areas where IN-STREAM indicators will be used. Therefore, one can argue that the case of Cohesion Policy can provide additional insights into how indicators on the different SIOOI levels can also contribute to other procedural instruments, such as SEA, that guide the Cohesion Policy process. In turn these instruments provide additional support and data for the indicators themselves. At the same time a clear evidence based link is needed between different indicators for different decision-making

levels in order to be able to monitor the outputs, outcomes and impacts of Cohesion Policy interventions. This is true for Cohesion Policy but obviously applies also to other areas where funding decisions are made. Here the adapted SIOOI-model is useful as it provides a link between the different indicators, making it possible to monitor the results of the strategic decisions that feed into future strategic decision-making. Consequently it is important that the relevant indicators are also incorporated within these procedural instruments, where relevant, in order to provide a coherent approach to the use of these indicators in support of better decision-making. At the same time there is also a hierarchy between procedural tools, as they apply to different decision-making levels, and it is equally important that the data for these procedural indicators feeds into each other. It is beyond the scope of this report to review in detail all the procedural tools that can be used within the Cohesion Policy cycle in relation to the SIOOI-model. However, an overview of these linkages between procedural tools (ex-ante evaluations, SEA and EIA) used in Cohesion Policy, the SIOOI-model and the Cohesion Policy stages is provided in the figure below.

Figure 6.3. Example of the relationship between Cohesion Policy stages, SIOOI-model and Procedural Instruments



6.2.5 Policy recommendations

EU Cohesion Policy has traditionally focused on economic and social developments and therefore has measured progress towards regional development in terms of purely economic

indicators, such as the GDP per capita and employment. Growth in GDP per capita, however, does not necessarily correlate with and reflect key factors for sustainable development, such as decreasing inter-regional disparities, well-being, prosperous development, and environmental sustainability and good governance. Given the multiple factors which are increasingly seen to determine regional development, a purely economic measurement based on GDP growth for the future Cohesion Policy might therefore no longer be justified and more holistic approaches to defining less developed regions and measuring progress would be required. In the short-term, options such as the human development index and the environmental pressures index, and determining regional genuine savings rates could be most politically feasible to complement the GDP at EU level. However, in the long term, a more fundamental reform about the way progress towards economic, social and territorial cohesion is measured is necessary, including ways of adjusting or even replacing the GDP.

A set of social and environmental indicators, following the state-input-output-outcome-impact model, should complement traditional economic indicators with a view to improving the performance and result-orientation of the post-2013 Cohesion Policy. This paper provides a framework and examples how such a set of indicators can be developed and recommends a selected number of potential candidates for expanding the list of 'core' indicators which can be adopted by Member States within their partnership contracts and respective Operational Programmes. Indicators should be designed to measure results and impacts, not only outputs. In the past, core indicators usually have included mostly output and to a lesser extent outcome indicators. We argue that if the future Cohesion Policy strives to improve its performance and result-orientation, future core indicators should instead include predominantly outcome and impact indicators.

The set of SD indicators needs to be embedded into the policy cycle of Cohesion Policy. The policy cycle approach is very useful to identify the entry points for different policy instruments (including indicators). It should be noted, though, that the Cohesion Policy cycle is more complicated since it is a multi-level governance and multi-dimensional policy. At the more strategic stage which is agreed upon at EU level, it is important to have a mix of state, impact and result indicators. At the programming stage, which is governed at national/regional levels, it is critical to establish the whole model of state-input-output-outcome-impact indicators. Setting out indicators early in the programming process is an important pre-condition that monitoring and reporting will take place during the implementation and evaluation stages of the policy cycle and will be consistent with already pre-established objectives, targets and conditionality.

In order to provide a more multi-faceted picture of regional development dynamics and trends, indicators such as the Human Development Index (HDI), At risk-of-poverty rate after social transfers, Adjusted Net Savings (or Genuine Savings) should be used alongside GDP. There might also be some scope for using the composite Index for environmental pressures, the ecological footprint, ecosystem indicators such as the moderation of extreme weather events and the total economic value of services provided by ecosystems, and using wider

natural capital accounts and/or economic and environmental accounts and associated indicators.

A comprehensive basket of SD indicators will inevitably require additional administrative capacities and technical support systems to guarantee the availability, collection, analysis and presentation of data in a format appropriate for the established indicators. Usually, authorities tend to measure policy results based on what data is available, meaning that they measure what they can and not what they should. Funding under Cohesion Policy technical assistance can be earmarked to develop the information/data systems that will allow managing authorities to measure what they should. Dedicate technical assistance from the current and future Operational Programmes should ideally be used to help Member States/regions develop capacity and information base for reporting and evaluation in relation to sustainable development.

7 Indicators for public communication and the press: empirical evidence and needs

> *Our biggest challenge in this new century is to take an idea that seems abstract - sustainable development - and turn it into a reality for all the world's people* (Kofi Annan, former UN Secretary General)

Gross Domestic Product, or GDP, is a very well known concept in our society. Maybe not everybody knows how it is calculated, but surely all know what it stands for. People are used to hear it mentioned almost daily on television, newspapers and in the internet. The signalling impact of GDP is extremely widespread, and almost everyone would worry about a stagnating, let alone declining, national income. The concept of economic growth embedded in the GDP figures has become a universal symbol of a country's wealth, and it is common to look for evidence about it on the media.

On the contrary, despite an increasing awareness on the importance of sustainable development, the issue of sustainability is arguably less reflected in the news. In particular, there is clearly not an indicator of sustainability as widespread as GDP. The uptake of such indicators by the media is still low, and several remain completely unknown to the general public.

Among the areas explored by IN-STREAM, public communication and the press is an important aspect for the future of sustainability indicators. Any successful move towards a new or reformed set of indicators for policy making depends on, inter alia, whether such metrics are perceived as useful and pertinent by the general public. Indicators that the press and the public can easily identify with and understand (e.g. GDP, unemployment rates, inflation etc.) are arguably more readily picked up by policy makers.

This chapter discusses some evidence and data on how certain sustainability indicators have been taken up by the press. It describes the methodology used for this (simple) statistical exercise to select indicators and media sources, the limitations to the scope of the work and the key findings of the research. Building on some examples from selected media, this analysis aims to provide a better understanding of which and how sustainability indicators have been most reported on, and what it is needed to improve their communicability.

7.I Methodology and its limitations

For the purpose of this report, a simplified statistical analysis was carried out, focusing on a selected number of sustainability indicators and media across a period of time, to understand which of them have been most mentioned, for what reasons and how often.

The first methodological step was to search for indicators used in major newspapers. It is useful to investigate the number of articles mentioning an index at least once, as this can be regarded as a measure of exposure of the index to the public. To keep the analysis simple, the search field was narrowed down to a specific set of sustainability indicators and across a limited number of English and French speaking media sources.

The number of media sources available in fact was extremely vast, therefore time and resources constraints required taking a very pragmatic approach. A number of criteria were used to select a small subset of media. Firstly, the analysis focused only on English and French language newspapers, due in part to language constraints and in part to the limitations of the search engine used (Factiva). Secondly, the search focused on media sources easily accessible to the wider public, either in printed form or online. It was considered in fact that, by limiting the search to widely read newspapers, the analysis could better measure the potential impacts on behavioural change of specific indicators. Finally, the research focused only on print media (mostly available also on line) as these were easier to identify and monitor. The analysis therefore did not cover television or radio media (e.g. TV news), since their revision would have been more demanding in practical terms. It also did not cover other online media, like thematic websites and online newsletters, given the extremely vast amount of material available in the internet.

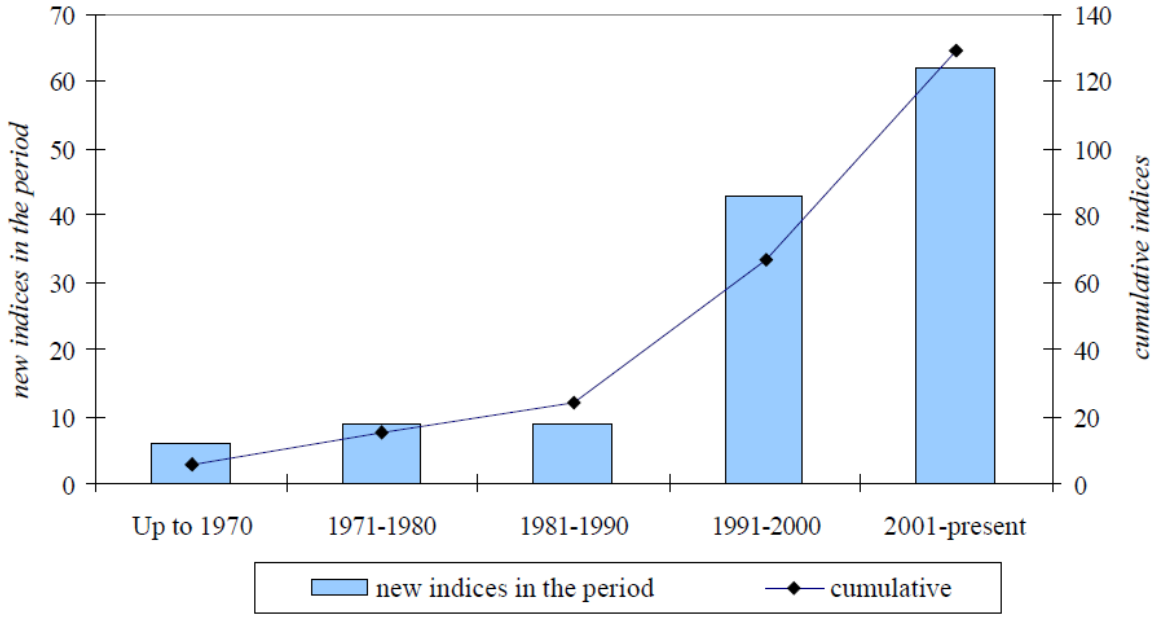
Overall, the research focused on 14 well known English and French press sources that were reviewed across a period of 20 years - these are listed in the table below. This is clearly but a small sample of the large amount of sources available, and does not take into account their circulation impact. The analysis therefore provides examples rather than full statistical evidence.

Table 7.1 List of Media Sources Used

English	French
Associated Press (EN)	Associated Press (FR)
BBC	Le Monde
Bloomberg	Le Monde Diplomatique
Economist	Les Echos
Financial Times (UK)	Liberation
Guardian	Reuters (FR)
Reuters (EN)	
The Times	

The amount of sustainability indicators available to the press is also considerable. Their number has dramatically increased in recent years, together with the growing interest on sustainability and environmental issues. The figure below gives an illustration of the rapid increase of composite indicators developed in the past decades.

Figure 7.1 Number of composite indexes measuring country performance



Source: Bandura, 2005

For practical reason, this part of the analysis only focused on a small group of 19 key indicators – shown in the table below. Six of them were chosen among the main IN-STREAM indicators (Common Bird Index, Red List, ANS, HANPP, HDI and Happy Planet Index). These were complemented with 13 other indicators that were selected by the study team. They were chosen either for their relative popularity among policy makers and experts (e.g. the Ecological Footprint, the Yale's Environmental Performance Index) or for their focus on key areas not fully addressed by the IN-STREAM indicators – in particular on wellbeing (e.g. Canadian Index of Wellbeing, Gross National Happiness), as this is becoming an increasingly discussed topic and likely more appealing to the media.

The choice of indicators also aimed to strike a balance across the three IN-STREAM storylines (biodiversity, resource efficiency, and green growth), to ensure that all were sufficiently covered. The table below shows the indicators selected and the storylines they are most relevant to (although clearly this is not always clear cut).

Table 7.2 List of Indicators used

indicators	Storylines		
	Biodiversity/	Resource Efficiency	Green Growth
Common Bird Index*	X		
Farmlands Bird Index	X		
Forest Bird Index	X		
Natural Capital Index	X	X	
IUCN Red List Index*	X		
Living Planet Index	X		
Mean Species Abundance	X		
Adjusted Net Savings (ANS) *		X	X
Sustainable National Income			X
Ecological Footprint	X	X	
Water Footprint	X	X	
Index of Sustainable Economic Welfare		X	X
Human Appropriation of Net Natural Productivity* (HANPP)	X	X	
Genuine Progress Indicator			X
Human Development Index* (HDI)		X	X
Canadian Index of Wellbeing	X	X	X
Happy Planet Index*		X	X
Gross National Happiness (GNH)		X	X
Environmental Performance Index	X	X	X

*IN-STREAM Indicators

Once the sets of indicators and media were selected, the Factiva publications search engine was used to filter the press coverage of sustainability indicators in articles published between January 1990 and March 2010. The aim was to identify articles which included detailed overviews of one or more of the indicators selected, or that focused on the wider issue of measuring sustainable development and wellbeing in developing and developed countries.

7.2 Main results

7.2.1 Most popular key sustainability indicators

This exercise, however limited in its scope, showed a number of interesting trends. First, it is clear that there is a wide disproportion between the number of references to GDP and the references to sustainability indicators in the press. A cursory analysis comparing articles mentioning sustainability indicators and those mentioning GDP illustrates summarily the difference in popularity between these two ways of measuring progress. For instance from

January 2009 to January 2010 one single newspaper (the Guardian online edition) published 268 articles discussing in detail GDP as an indicator of progress. As a comparison, sustainability indicators received, across all media sources analysed, 17 mentions over the same time period.

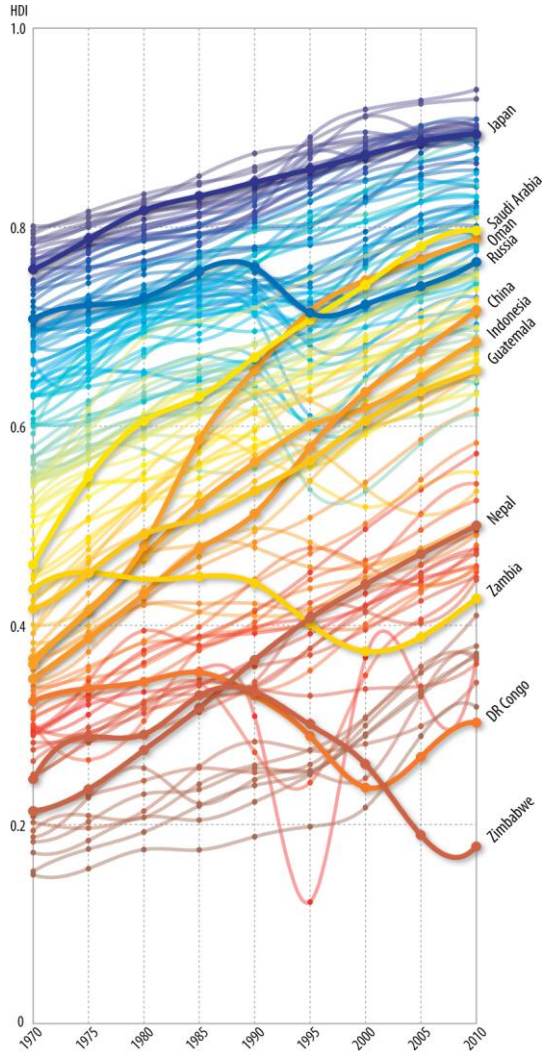
Among sustainability metrics, it appeared that indicators measuring social factors, like human development and happiness, as well as the two Footprints indicators, received more attention from the press analysed, over time, compared to other indicators assessed. In particular the Ecological Footprint, the Human Development Index (HDI) and the Gross National Happiness (GNH) have received the most mentions. Other wellbeing indicators, namely the Living Planet Index, the Index for Sustainable Economic Welfare and the Genuine Progress Indicator also received some attention. The Ecological Footprint alone accounts for close to a quarter (24 per cent) of all mentions followed by the HDI (17 per cent) and the GNH (14 per cent).

The HDI and the Ecological Footprint are often cited as two examples of indicators that could be used to complement and go further than the current system of measuring progress through GDP. A recent paper by Morse (2011) on selected UK newspaper also shows a steady increase in the number of articles quoting HDI and the Ecological Footprint between 1994 and 2009.

The HDI is typically given detailed overviews as soon as new yearly data is compiled and publicly released by the United Nations. Likely, the fact that the indicator is published and updated regularly by a widely recognised body like the United Nations ensures a significant level of authoritativeness and popularity among the general public. HDI publications are also usually accompanied by extensive press releases and information material which can be easily be picked up by the media (see also Morse, 2011). Furthermore, the extensive use of maps and graphs by the HDI reports likely increases the clarity and communicability of the indicator – see for example Figure 7.2.

The Footprint indicators also appear to have a strong appeal on the media. If included together, the Ecological Footprint and the Water Footprint account for close to a third of all mentions (29 per cent). This can be

Figure 7.2 Worldwide trends in the Human Development Index 1970-2010

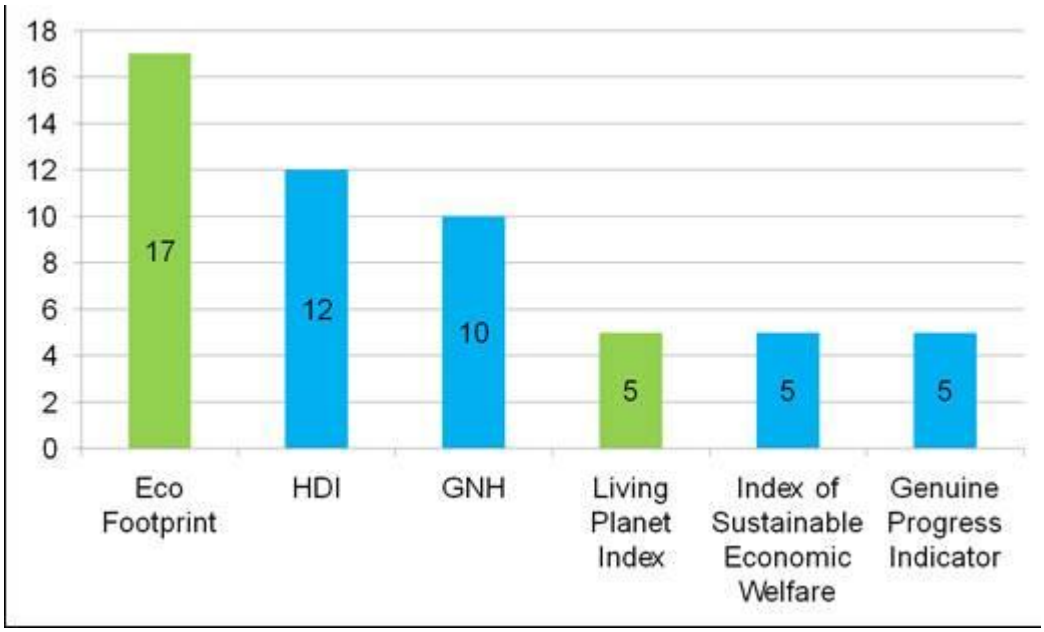


Source: UNDP, 2010

related to the easily understandable message provided by the indicator ('how many planets we are consuming') as well as a significant awareness campaign by some NGOs. For instance, the 'Living Planet Reports', by the World Wildlife Fund (WWF) typically include 'league tables' of Ecological Footprint (Morse, 2011). Interestingly, however, despite the information on the construction and assumptions behind the Footprint which is made available by its authors, such technical details are rarely picked up by the media. This is understandable given that their complexity, but it means that the readership has to take the indicators at face value (Morse, 2011).

The GNH indicator, arguably, appeals to the press because of its novel focus on happiness - a value readers can easily relate to. Media also stressed its unusual construction process as a state objective of the Kingdom of Bhutan. It is also mentioned regularly due to specific forums and meetings on gross national happiness taking place.

Figure 7.3 Highest number of mentions by indicator in selected media



From the analysis it also emerged that a number of the indicators selected for this analysis were not mentioned at all in the publications monitored. This is notably the case for a series of biodiversity status indicators, such as the Mean Species Abundance, the Common Birds Index and the Farmland Birds Index.

Notably, the fact that the Common Bird Index, a headline indicator in the EU's Sustainable Development Strategy, receives no mentions, seems to suggest that some of the key indicators used in EU sustainable development policy-making are not sufficiently well-known or understood by the wider public, raising the issue of improving the spreading of information on these topics.

It is also apparent that some indicators or sets of indicators are mentioned in multiple media sources in the same time period, clustered around a specific event. This is the case, for instance, when a new indicator is developed. For example, when the genuine progress indicator was first publicly launched in autumn 1995, it was mentioned a number of times in various English speaking media sources.

The publication of country rankings based on a sustainability indicator is also often picked up by several media as soon as the data are released. This was the case, for example, when the latest figures regarding the happy planet index were released in July 2009 – see figure below.

Figure 7.4 HPI by sub-region

Source: NEF, 2009

International or domestic political and institutional events also result in a heightened mention of specific indicators or, in general, of the need to go beyond GDP to measure progress. For example, French speaking media commented heavily on the setting-up and later developments of the Stiglitz Commission (see chapter 2.4.1) and used this as a platform to debate the wider problem of measurement and indicators. Key dates include the setting up of the commission itself in early 2008, the launch of a public consultation in June-July 2009 and the Commission's final report released in the autumn of 2009. The build up to the Copenhagen summit of December 2009 also acted as a catalyst for wider discussions on indicators and November-December 2009 saw a number of articles and editorials that included analyses of existing and planned sustainability indicators.

7.2.2 Conclusions and recommendations

This exercise made apparent that the analysis of indicators in the media faces inevitably a number of limitations, due to the vast number communication media and indicators available today. The methodology adopted for this analysis clearly covered only a limited number of sources and indicators, and therefore aimed to provide illustrative examples rather than an exhaustive statistical analysis. It is therefore important to note that the findings detailed in this chapter are only an outline of examples and possible trends based on selected media rather than clear-cut conclusions. Nevertheless, the number of articles mentioning an index could still be regarded as a first indication of the measure of exposure, and even from this limited analysis it was possible to identify some interesting lessons.

First, among the sustainability indicators analysed, the most popular appear to be those measuring a combination of economic and social factors (e.g. HDI, GNH). In the selected media analysed, such indicators received far more attention over time than pressure or status indicators linked to specific environmental matters, like biodiversity. In some cases this appears to be related to the reputation of the source (e.g. the United Nations for the HDI), as well as the 'popularity' of the issue measured (e.g. 'happiness' is a topic that people can easily relate too). Other indicators, like the water and ecological Footprints, are generally very popular thanks to their capability convey a complex metric in an easily understandable way that the public can 'relate' to (e.g. ecological impacts measured in terms of 'planets' we use). Marketing and/or awareness campaigns conducted by NGOs are also helpful in disseminating the message of an indicator. Furthermore, the publication of an index by its developers, when associated with the release of colourful and attractive reports and 'press packs' designed to attract attention to the cause being promoted by the index (Morse, 2011), is also more easily picked up by the media.

In the print media there appear to be an overwhelming focus on indicators measuring social and economic factors at the expense of those measuring the pressures on and status of biodiversity. This lack of attention from the media can be in stark contrast, in some cases, with decision-making actors. For example, the Common Bird Index is a headline indicator in the Sustainable Development Strategy and is widely known and discussed in the wider policy community but, across more than 20 years, has never been mentioned in the selected media sources.

Sustainability indicators as a whole are, seemingly, rarely referred to as alternatives to GDP when measuring or discussing a country's progress/growth. A cursory research shows a vast difference in popularity between the two sets of indicators. Nonetheless, the limitations of GDP in measuring true progress have been extensively discussed in the print media.

Discussions on this topic, and on sustainability indicators in general, have tended to cluster around specific events, such as domestic or international political developments, the regular publication of statistical or qualitative reports on sustainable development, and the creation of a new indicator.

Overall, there appear to be still a wide disproportion between the coverage of sustainability indicators and of traditional mainstream indicators, like GDP. Often, the alternative indicators mostly taken up by the media are not necessarily the most important at policy level. The media tend to prefer indicators that are easy to understand and that the people can more easily relate to, or indicators that are already strongly publicised by their creators. They also tend not to discuss the methodological implications and nuanced meanings of the indicators, leaving the readers with little opportunity to question their validity.

There is clearly a gap between the sustainability indicators that are most used or needed by policy makers and the information passed on to the general public. There is therefore a need to improve the communicability of some key indicators, for instance by translating their result into more understandable messages and increasing public interest though more frequent awareness rising campaigns.

On the other hand, some indicators may be simply too complex to be easily communicated. For instance, an indicator like the Human Appropriation of Net Primary Production (HANPP) can be extremely informative for policy making (see e.g. its potential used for agriculture, chapter 4.2), but too technical to be communicated to the general public. Others indicators, like the Ecological Footprint, are sometimes considered less robust by the scientific community, but widely taken up by the media for their clear message. Similarly, an accurate indicator like the Marine Trophic Index (MTI) can be difficult to be appreciated by the public, while a more simple measure of 'fish catch' is significantly easier to communicate. This does not mean that some indicators are better than others, but rather that indicators can have different functions. While some may be more suitable for policy and research, others would be more appropriate to communicate a message to the outside world.

It is therefore important that the right indicators are used for the right purpose. There is sometime a trade-off between meaningfulness and clarity that should be taken into account in policy making. While in general the communicability of sustainability indicators and the awareness around their importance should be improved, it may also be necessary to choose different indicators for analysis and for communication. This can ensure that the most robust indicators are used to inform policy choice, and at the same time that the importance of sustainability criteria is fully appreciated by the public.

8 Key findings and policy recommendations

Indicators arise from values (we measure what we care about) and they create values (we care about what we measure) (Meadows, 1998)

The policy analysis undertaken in this report highlighted a number of important considerations and recommendations that are summarised below.

The **policy cycle** can be a useful approach to understand and improve how sustainability indicators can support the policy making process. By breaking down policy development into clear, distinguishable stages, the decision making process becomes more understandable, allowing for useful comparisons and analyses of distinct stages, and helping to identify weaknesses and opportunities in each step of the policy making process. This, complemented by the DPSIR (Driver-Pressure-State- Impacts- Response) model, can also help clarifying what type of indicators have been used so far and for what purpose, and how they should develop in the future. Notably, it is apparent that **there are currently a fair number of indicators that focus on state and pressures, while fewer are measuring impacts and responses.** As a result, indicators seems to be used especially in the early phases of the policy cycle, e.g. for problem recognition and decisions on policy options. There is scope to use indicators further, especially in the later stages of policy development. Monitoring and ex-post analyses should arguably be improved, both at EU and Member State level, in order to assess the effectiveness of policies, and sustainability indicators will be essential to make sure social and environmental considerations re duly taken into account.

The use of 'environmental accounts' is important for integrating environmental considerations into policy decision. Frameworks like the **Natural capital accounts** (measuring stocks of assets: forests, fish, land as well as soil, water, carbon in soils) and the **System of Economic and Environmental Accounts (SEEA)** have a lot of potential and should be further supported by European, national and local institutions and statistical offices within the wider global context (SEEA is a United Nation led process, complementing the UN System of National Accounts - SNA). The recent Regulation on European environmental economic accounts (No 691/2011) is a step in the right direction, but further efforts to streamline these systems with the standard economic accounts should be encouraged.

The objectives of halting biodiversity loss, coupled with the new aim of halting ecosystem service losses, improve restoration of natural areas and the new interest in green infrastructure each require additional inputs in biodiversity indicators. In particular, the importance of **ecosystem service indicators** is increasingly recognised. For instance,

nik stressed the

need to develop indicators to better measures natural capital and its eco nik, 2011). These should be taken into account in several policy areas, not only in biodiversity and nature related policies. For instance, they can be crucial indicators to make sure that the state of our ecosystems are duly taken into account in climate change policies, as well as other economic, social and environmental measures.

The issue of **ecological thresholds and tipping points** is of particular concern, as are issues of resource limits and planetary boundaries. Due to unsustainable resource exploitation and increasing pollution and climatic changes, it is expected that some natural resources will become irreversibly lost and that some ecosystems can be pushed to a point beyond which they can no longer withstand external pressures. Whether such threshold points, which mark the boundaries of system integrity, are trespassed, there may be critical results, often irreversible; for example, rivers can become unable to support life if oxygen levels fall below a certain point (ten Brink et al., 2008). This issue can be particularly detrimental for biodiversity, agriculture and fishery, and should arguably be taken into account in a broad range of policies. Sustainability indicators have a key role to play, as they can inform about the proximity of such ecological and resource thresholds and the speed at which we are reaching them, and therefore help developing adequate policies to prevent breaching them.

The recognition of the **over-exploitation of EU fisheries** (with it being an 'underperforming natural asset') as well as of damage to the marine environment, underlines the importance of having good indicators to measures fish stock, assess the state of marine ecosystems, determine sustainable yields, set targets and monitor progress, as well as to measure the performance of the Common Fisheries Policy and the impact of the flow of services to communities.

In **agriculture policy**, the importance of **public goods** aspects (encouraging public goods such as carbon storage in soils, water retention, purification and flood control and avoiding public bads of pollution, impacts on water quality and availability, erosion) merits additional efforts at develop both biodiversity and ecosystem service indicators to ensure that the wider public goods can duly be taken into account in decisions, funding, investments and instrument design, implementation, monitoring and evaluation.

It is of foremost importance to reduce the environmental impacts related to **resource consumption** (materials, water, energy, land and associated biodiversity). To do so, resource efficiency indicators and targets should be set. Attention will be needed to develop data sets on stocks of materials, as flows on their own do not address over-consumption of either renewable or finite resources. Introducing resource related indicators in sectoral policies will be crucial for target setting and monitoring of resource use by specific sectors of the economy and/or products, especially those with the largest environmental impacts (e.g. housing, food and drink, and mobility). Furthermore, as resource scarcity is a global issue, EU indicators and policies should take into account environmental impacts that are occurring

abroad.). It will be critical to assess the level of decoupling of resource impacts from economic growth and implications for future resource availability, prices, impacts and, ultimately, the sustainability of our socio-economic model and practices.

In order to monitor the achievement of the ambitious EU **climate change** targets, sustainability indicators have a crucial role to play, especially GHG emissions, energy intensity and the share of renewable energy consumption in total final energy consumption. This applies at global, national, local, business and citizen levels. It should also be taken into account that climate change indicators are often linked to trends of other indicators (socio-economic, environmental, energy related indicators). This calls for a more explicit identification of these linkage and consideration of cross-policy impacts at the most relevant stages in the policy cycle.

The focus of **Cohesion Policy** (CP) on economic development, and particularly growth and jobs, has arguably led to granting more importance to the use of economic and employment indicators, at the expense of other sustainability indicators, especially on the environmental domain. The development of a coherent and robust system of sustainability indicators, suited to account both for outcomes and results, is therefore critical in the context of Cohesion Policy. These should be embedded at the level of policy, programme and project. This will be important for understanding the impacts of the operational programmes (OPs) under CP, the development path encouraged by investments, instruments and governance, for creating a valuable evidence base to support decisions by regional policy makers (e.g. informing investment in infrastructures, encouraging job creation all the while committing to environmental principles and objectives such as carbon neutrality or no net loss of biodiversity) as well as for appreciating the inter-linkages between economic, social and eco-systems. This will require additional administrative capacities and technical support systems to guarantee the availability, collection, analysis and presentation of adequate data.

There is clearly a gap between the sustainability indicators that are most used or needed by policy makers and the information passed on to the general public. There is therefore a need to improve the **communicability** of some key indicators, for instance by translating their result into more understandable messages and increasing public interest though more frequent awareness rising campaigns. On the other hand, some indicators may be simply too complex to be easily communicated. For instance, an indicator like the Human appropriation of net primary production (HANPP) can be extremely informative for policy making, but too technical to be communicated to the general public. Others indicators, like the Ecological Footprint, may be sometimes considered less robust by the scientific community, but widely taken up by the media for their clear message. This reveals that there is sometime a trade-off between meaningfulness and clarity that should be taken into account in policy making. This does not mean that some indicators are better than others, but rather that indicators can have different functions. It is therefore important that the right indicators are used for the right purpose. While in general the communicability of sustainability indicators and the awareness around their importance should be improved, it may also be necessary to choose different indicators for analysis, policy setting, instrument design, performance checking, consumer information and wider public communication,

including easily recognised indicators that motivate action (e.g. footprints, product labels and ratings including energy labels for products and buildings) There is also a need for timely, local and regular data to make the relevant issues 'live' for the public – which will require commitments for monitoring, reporting as well as 'now-casting'. This can ensure that the most robust indicators are used to inform policy choice, and at the same time that the importance of sustainability criteria is fully appreciated by the public.

The challenges facing policy makers in the next 5 to 10 years are different than those of a decade or two ago. At one level a lot of the legislation is in place and the changes needed are rather related to implementation, review and renewal (e.g. progress from 20/20/20 climate and energy target towards low a progressively more ambitious milestones and targets en route to a low carbon economy by 2050). The policy challenges are also increasingly complex. In the early days of legislation it was about single issue solutions such as emissions standards for effluent. Currently, policies are required about interconnected issues like climate change, biodiversity and resource efficiency, which also have major interconnection with actors and activities in other sectors. Furthermore, in this time of economic and financial crisis, there is an ever stronger need for a clear evidence-base to promote policy, design instruments and check performance. Finally with the growing economy and world population and associated growth in consumption and production, there is increase stress on the world's resources and ecosystems, with both resource limits and ecological thresholds either being breached or in danger of being so. This could induce changes that could be potentially dramatic, non-linear and irreversible. In light of these considerations, there is a critical role for sustainability indicators to play and also a fundamental need to move towards fuller integration of different environmental issues in national policies as well as economics and environmental accounts. Finally, there is a value in having an increasing informed public so that citizens can also participate in debates, make informed choices and be a core driver to the transition to a resource efficient, low carbon, economy that respects ecological values and resource limits and supports wellbeing and progress.

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Appendix I – Glossary

A brief definition of the IN-STREAM Indicators is provided below (see also deliverable xx for full analysis), together with other selected indicators related to this report.

IN-STREAM indicators:

Economic indicators and accounting frameworks:

- **Gross Domestic Product** is defined as the total market value of all final goods and services produced within a country or region in a given period of time (OECD, 2002).

- **SEEA Framework** is an international coherent and comprehensive accounting framework for objectively and consistently measuring how environmental functions contribute to the economy and how the economy exerts pressures on the environment (Pedersen and de Haan, 2006).

- **Adjusted Net Savings (Genuine Savings)** measures the true rate of savings in an economy after taking into account investments in human capital, depletion of natural resources and damage caused by pollution (World Bank, 2009).

Subjective wellbeing indicators / frameworks:

- **Happy Planet Index** combines environmental impact with human well-being to measure the environmental efficiency with which, country by country, people live long and happy lives.

- **National Accounts of Wellbeing (NAW)** aims to provide governments a consistent framework for collecting and systematically measuring people's subjective well-being.

- **Human Development Index (HDI)** is a measure of the average development of a country in three basic areas of human development: Gross Domestic Product, Life expectancy, Educational enrolment and Literacy.

Biodiversity indicators:

- **Red List Index** measures trends in projected extinction risk for taxa groups or sampled taxa.

- **Pan European Common Bird Monitoring Scheme (PECBMS)** index measures changes in biodiversity as reflected by a wide suite of common bird populations, primarily of farmland and forest habitats (Gregory et al 2005).

- **Potentially Disappeared Fraction (PDF)** can be referred to as the number of species missing in an area of a particular land use relative to a reference state.

- **Favourable Conservation Status** (of habitats and species) can be described *'as a situation where a habitat type or species is prospering (in both quality and extent/population) and with good prospects to do so in future as well.'*[79]

- **The Marine Trophic Index (MTI)** measures the change in mean trophic level of fisheries landings by region and globally. Trophic level is defined as the position of an organism in the food chain (CBD, 2004 (1))

Resource efficiency indicators:

- **Energy Intensity** is the ratio between the gross inland consumption of energy (or total energy consumption) and Gross Domestic Product (GDP) calculated for a calendar year.

- **Greenhouse gases emission** indicators encompass a variety of measurements on the emission and concentration of Greenhouse gases in the atmosphere.

- **Generation of Industrial and Municipal Solid Waste** aims to quantify the production of waste on a weight basis at the point of production, measured in tonnes per capita per annum.

- **Generation of hazardous wastes** measures the total amount of hazardous wastes generated per year through industrial or other waste generating activities, according to the definition of hazardous waste as referred to in the Basel Convention and other related conventions.

- **Management of Radioactive Waste** provides a measure of both the current status of radioactive waste management at any point in time and the progress made over time towards the overall sustainability of radioactive waste management.

[79] Assessment, monitoring and reporting of conservation status – Preparing the 2001-2007 report under Article 17 of the Habitats Directive (DocHab-04-03/03 rev 3).

Non-IN-STREAM indicators used for the media analysis (chapter 7) – brief description:

- **Farmlands Bird Index:** Index of birds found on farmland alone, established by RSPB
- **Forest Bird Index:** Index of birds found in forests alone, compilation of data from 28 common forest bird species across Europe
- **Natural Capital Index:** an indicator that approximates terrestrial and aquatic biodiversity of natural ecosystems and agricultural land, respectively
- **Living Planet Index:** an indicator of the state of global biological diversity, based on trends in vertebrate populations of species from around the world
- **Mean Species Abundance**: an index which calculates the mean trend in population size of a representative cross section of the species, in line with the CBD 2010 indicator for species abundance
- **Index of Sustainable Economic Welfare**: an economic indicator intended to replace the gross domestic product. Rather than simply adding together all expenditures like the gross domestic product, consumer expenditure is balanced by such factors as income distribution and cost associated with pollution and other unsustainable costs
- **Sustainable National Income:** The sustainable national income in a given year is an estimate of the production level at which - with the technology in the year of calculation - environmental functions remain available 'for ever'
- **Canadian Index of Wellbeing:** a composite index taking into account different, but interconnected, categories of wellbeing: Living Standards, Healthy Populations, Community Vitality, Democratic Engagement, Time Use, Leisure and Culture, Education and Environment. Full description at http://ciw.ca/en/
- **Gross National Happiness**: refers to the concept of a quantitative measurement of well-being and happiness. Full description: http://www.grossnationalhappiness.com/gnhIndex/intruductionGNH.aspx
- **Genuine Progress Indicator:** a measure of whether a country's growth, increased production of goods, and expanding services have actually resulted in the improvement of the welfare (or well-being) of the people in the country
- **Environmental Performance Index:** The 2010 Environmental Performance Index (EPI) ranks 163 countries on 25 performance indicators tracked across ten policy categories

covering both environmental public health and ecosystem vitality (specify what it measures: climate change etc.) .Full information at http://epi.yale.edu/

- **Ecological Footprint:** a measure of human demand on the Earth's ecosystems. It compares human demand with planet Earth's ecological capacity to regenerate. It represents the amount of biologically productive land and sea area needed to regenerate the resources a human population consumes and to absorb and render harmless the corresponding waste

- **Water Footprint:** an indicator of water use that looks at both direct and indirect water use of a consumer or producer. The water footprint of an individual, community or business is defined as the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business. Full information at http://www.waterfootprint.org/?page=files/home.

Other non- IN-STREAM indicators related to specific policy analysis are described in chapters 4-5-6.

Appendix II – Indicators for fishery and cohesion policy

Appendix II. 1. Table indicators section on fisheries policy

Policy area	Section	Indicator	Rate
C	**1**	Proportion of commercial stocks that are within safe biological limits	1
C	**2**	Relative abundance of a set of populations that are not regularly assessed but which are decreasing in number.	2
C	**3**	Average size (length and weight) in the community	1
C	**4**	Mean trophic level	2
C	**5**	Mean maximum length	2
C	**6**	Biodiversity indicators	2
C	**7**	Trends in abundance of sensitive benthos species.	1
C	**8**	Area coverage of highly sensitive habitats.	2
C	**9**	Total aquaculture production and total area occupied by aquaculture installations	1
C	**10**	Effluent water quality	2
C	**11**	Eco-efficiency of aquaculture	2
C	**12**	Potential impact of aquaculture, and particularly on the impact of reared fish (e.g. salmon) escaping from fish farms, on the genetic structure of wild (fish) populations.	2
S	**13**	Effective fishing capacity (adjusted fishing effort) and its spatial and temporal distribution	1
S	**14**	Structural support and proportion allocated to promote environmental friendly fishing practices.	2
S	**15**	Mapping of effort distribution over the sensitive areas	1
S	**16**	Use of environmentally friendly gears	1
S	**17**	Oil consumption as a proxy for CO2 production.	2
S	**18**	Unwanted by-catches of protected species and discards	2
M	**19**	Share of fish produced (or consumed) that are eco-labelled.	2
M	**20**	Initiatives to support eco-labelling and use of eco-labels and similar awards	1
M	**21**	Amounts of fish taken out of the market and/or traded on secondary (intervention) conditions.	1
M	**22**	Size of the European market for fish	2
M	**23**	Changes in consumer preferences in relation to environmental issues	2
H	**24**	Number of inspections per landing	1
H	**25**	Number of infringements over number of inspections.	1
H	**26**	Level of imposition of punishment	2
H	**27**	Attitudes and awareness of stakeholders towards CFP environmental goals	1
H	**28**	Total quantity of funds allocated to relevant research and distribution of research funds	1
H	**29**	Scientific advice in decision making	2
H	**30**	Policy makers performance	2
M	**31**	Proportion of landings covered by catch plans	2
H	**32**	Number of violations (assuming that inspection is efficient)	2

Annex II.2. Regional Policy: Core environmental and social indicators proposed by the Commission, 2006

Theme	Proposed 'core' indicator
Renewable energy	Number of projects
	Additional capacity of renewable energy production (MW)
Environment	Additional population served by water projects
	Additional population served by waste water projects
	Number of waste projects
	Number of projects on improvement of air quality
	Area rehabilitated (km2)
Physical and environmental regeneration	Number of projects ensuring sustainability and improving the attractiveness of towns and cities
Climate change	Reduction greenhouse emissions (CO2 and equivalents, kt)
Prevention of risks	Number of projects
	Number of people benefiting from flood protection measures
	Number of people benefiting from forest fire protection and other protection measures
Social inclusion	Number of projects offering services to promote equal opportunities and social inclusion for minorities and young people
Jobs created	Gross direct jobs created, full time equivalents

Source: European Commission (2006) *Working Document No 2: Indicative Guidelines on Evaluation Methods: Monitoring and Evaluation Indicators*, DG Regional Policy

Annex II.3. SIOOI (State, Input, Output, Outcome, Impact) indicators that are/could be used in Cohesion Policy

Pillar	Theme	Indicator				
		State	Input	Output	Outcome	Impact
Economy	Convergence, competitiveness and productivity	Dispersion of regional GDP per inhabitant; Net national income (NNI); Natural capital / assets base; Economic value of ecosystem and their services; Economic losses due to extreme weather events; Energy intensity of the economy.	Allocation of EC co-financing (euro) for businesses and entrepreneurship; Allocation of EC co-financing for 'win-win' measures for the economy and environment.	Number and total funding of projects seeking to promote businesses and entrepreneurship; Number of start-up businesses.	Ratio of entrepreneurs /population; Production of environmental good and services; Multi-factor productivity including environmental services.	Changes in the Gini co-efficient; Changes in the households disposable income per capita; Changes in the economic value of natural capital and associated ecosystem services; Changes in economic losses due to extreme weather events; Changes in the energy intensity of the economy.
	Innovation	Turnover from Innovation; Total R&D expenditure; Energy intensity of the economy; Regional Innovation Performance Index (RIPI).	Allocation of EC co-financing (euro) for R&D and eco-innovation.	Number and total funding of R&D projects with relation to eco-innovation and green services/ products; Number and total funding of cooperation projects enterprises – research institutions related to environment.	Number of Patents related to the environment applications to the European Patent Office (EPO); Proportion of E-Commerce via Internet; E-government on-line availability; Broadband penetration rate.	Changes in the turnover from eco-innovation; Change in the Regional Innovation Performance Index (RIPI); Changes in total R&D related to the environment expenditure.
Social	Employment	Dispersion of regional employment rates by gender;	Allocation of EC co-financing (euro) for labour market	Additional job opportunities created;	Proportion of people employed in the green economy sector;	Changes in the dispersion of regional employment rates by gender;

		Unemployment (male, female, youth, etc.).	measures.	Number and total funding of project s stimulating green jobs and prequalification of personnel.	Proportion of people employed in high-tech sectors.	Changes in unemployment (male, female, youth, religious orientation, etc.).
	Poverty and social inclusion	Inequality of income distribution; Persistent-at-risk-of-poverty rate by gender; Proportion of public having access to environmental services; Human Development Index (HDI).	Allocation of EC co-financing (euro) for poverty alleviation and social inclusion measures.	Number and total funding of projects offering services to promote equal opportunities and social inclusion for minorities and young people.	Proportion of population having access to environmental services; Proportion of population having access to sustainable mobility.	Change in population at-risk-of-poverty or exclusion by gender; Change in proportion of population having access to environmental services; Change in persistent-at-risk-of-poverty rate by gender; Changes in the Human Development Index.
	Health	Life expectancy at birth; Infant mortality; Exposure to air pollution; Environmentally induced health problems and related costs.	Allocation of EC co-financing (euro) for measures improving health and safety .	Number of people that are provided with access to quality health service.	Proportion of population having access to quality health services.	Change in life expectancy at birth; Change in infant mortality; Risk/Incidence of morbidity, early mortality and loss of life years Cancer incidence rate, by gender and by type.
	Education and training	Enrolment rates; Proportion of the population with upper secondary/tertiary qualifications related to environmental goods	Allocation of EC co-financing (euro) for education/training related to SD measures;	Number of projects providing life-long learning by gender; Inclusion of SD/green economy aspects in school and university	Success rate of training (% finding employment on completion); Proportion of people trained and pre-qualified to participate in the green	Change in enrolment rates; Change in the Proportion of people trained and pre-qualified to participate in the green economy labour

		and services;		syllabi;	economy labour market;	market;
Environmental	Nature and land use	Proportion of species lost or in decline; Red-list index; Fragmentation of habitats ; Incidence of natural risks and extreme weather events (including flooding, desertification, sea rise, etc.); Visual attractiveness of regions.	Allocation of EC co-financing (euro) for natural capital, biodiversity and ecosystem services.	Number of people having access to green spaces; Number of visitors to protected sites per year; Number (and/or total funding) of projects supporting ecosystem services; Proportion of developments on greenfield/ brownfield sites; Number of projects for preparedness, early warning systems and adaptive capacities to natural risks and climate change.	Greenfield development as % of total new development; New dwellings built on previously developed land; Proportion of habitats in a favourable condition/ good ecological status; Extent of/change in green infrastructure, especially in urban areas; Changes in the number of people being at risk from natural risks and extreme weather events.	Changes in the proportion of habitats in a favourable condition / good ecological status; Changes in land capacity to adapt to natural risks; Changes in the proportion of species lost or in decline; Changes in the Red-list index; Improved visual attractiveness of regions.
	Water and air	Amounts of pollutants in water and air; Water availability (include aquifer levels) and consumption.	Allocation of EC co-financing (euro) for water management and air pollution abatement; Resource pricing	Additional population connected to urban waste water treatment; Additional population served by waste water projects; Number and total funding of projects improving air quality;	% coastal sites complying with Bathing Water Directive; Domestic water consumption (litres per person per day); Total Abstractions from non-tidal surface and ground water; Rivers of good biological quality and chemical quality (percentage of classified river length);	Changes in the amounts of pollutants in water and air; Changes in water availability and consumption; Health impacts (range of indicators).

					Days when air pollution is moderate or higher (average number of days per site); Changes in air quality (changes in emissions of CO2 or GHG, NOx and SOx).	
	Sustainable Transport	Urban population exposure to air pollution from transport; Greenhouse gas emissions by transport mode; Number of people killed in road accidents; Energy consumption of transport relative to GDP.	Allocation of EC co-financing (euro) for sustainable transport.	Additional population served with improved urban transport ; Number of project applying user charging.	Modal split of passenger transport; Modal split of freight transport; Volume of freight transport relative to GDP; Volume of passenger transport relative to GDP; Internalisation of the external costs.	Change in energy consumption of transport relative to GDP; Changes in Urban population exposure to air pollution from transport; Changes in greenhouse gas emissions by transport mode.
	Climate change and energy	Greenhouse gas emissions by sector (including sinks); Total carbon dioxide emissions per capita (kilograms carbon equivalent per resident); Renewable primary energy consumption Final energy consumption by sector	Allocation of EC co-financing (euro)	Number and total funding of projects supporting renewable energy production; Number (and/or total funding) of projects reducing greenhouse gases;	Share of renewables in gross final energy consumption; Share of renewable energy in fuel consumption of transport; Improved energy efficiency by sector Energy savings realised Ratio between renewable energy consumption & total energy consumption.	Change in greenhouse gas emissions by sector (including sinks); Change in total carbon dioxide emissions per capita (kilograms carbon equivalent per resident) Changes in final energy consumption

		Availability of renewable resources per type Energy savings potential per sector				
	Sustainable consumption and production	Generation of waste by sector; Water use by sector; Energy consumption by sector; Household waste arising per person;	Allocation of EC co-financing (euro) for SCP and natural resources management	Number of SMEs/industry supported for introduce/enhance environmental products and services and improve production processes; Number and total funding of projects supporting Green Public Procurement; Number of organisations certified under environmental management systems; Number of organisations participating in ecolabel schemes.	Resource efficiency gains; Proportion of Green Public Procurement of total procurements; Proportion of organisations certified under EMAs; Proportion of organisations participating in ecolabel schemes; Proportion of organisations and sites with an environmental management system ; Domestic water consumption (litres per person per day); Proportion of eco-label products consumed;	Changes in water use by sector Changes in generation of waste by sector; Change in household final consumption expenditure per capita; Change in household waste arising per person
Institutional/ governance	Partnership	Public engagement and participation in decision-making; Transparency of procedures; Partnership.	Allocation of EC co-financing (euro) for good governance.	Number of NGOs participating in working groups and monitoring committees; Number of public consultations; E-Government on-line availability;	Intensity of involvement in community and organisational life; E-government usage Number of comments submitted by NGOs and the general public to public consultations;	Improved public engagement and participation in decision-making; Improved transparency of procedures; Strengthened partnership

					Number of comments integrated into the final text of a programme.	
	Administrative capacity	Capacity of public authorities to implement EU environmental *acquis* (both sectoral and horizontal) ; Capacity of public authorities to deal with environmental integration into non-environmental interventions co-financed by EU funds.	Allocation of EC co-financing (euro) for institutional capacity development, good governance and technical assistance related to SD issues.	Networks of environmental authorities; Administrative units tasked with environmental integration; A number of projects / technical assistance targeting SD plans, strategies, feasibility studies, SD indicators development, SD evaluations.	Improved administrative capacity and technical base to programme and implement SD projects, promote win-wins and mitigate trade-offs; Improved administrative capacity and technical base to use SD indicators; Proportion of Cohesion Policy funds absorbed.	Changes in knowledge, skills and capacity of public authorities; Improved environmental integration in Cohesion Policy programmes/projects; Quality of government.

Sources: IN-STREAM; Eurostat (websites); OECD, 2001; OECD, 2011; Ekins and Medhurst , 2003; EEA, 2010; EC, 2006

Appendix III Policy questionnaire for stakeholder consultation

In-Stream: INtegrating MainSTREAM Economic Indicators with Sustainable Development Objectives - FP7 ENV 2007.1.

Questionnaire: Different indicator approaches in policy-making

On the use of sustainable development indicators in [area] policy

Policy Context: A number of recent policy developments have put environmental, economic and social indicators back at the top of the Agenda. The key role indicators play in structuring discussions and informing policy decisions can hardly be called into question. The Commission's Europe 2020 Strategy, which aims for a '*smart, sustainable and inclusive growth*' and sets a number of headline targets, the debate on EU's budget after 2013, and the reform of a number of key EU policies of utmost relevance for sustainability, including Cohesion policy, the Common Agricultural and Fisheries Policies, all present new opportunities to improve the use of environmental, economic and social indicators at the different stages of policy-making. Ongoing initiatives such as The Economics of Ecosystems and Biodiversity (TEEB)[80] and Beyond GDP[81] also focus on indicators. The European Commission funded IN-STREAM project (http://www.in-stream.eu/) acknowledges these important developments and makes it a priority to provide the knowledge base to support the selection of adequate indicators in a number of key policy areas.

IN-STREAM objective: One of the main aims of the IN-STREAM project is to investigate how the use of indicators can help achieving policy-outcomes consistent with the commitment to sustainable development and, in particular, the integration of the environmental dimension into relevant policy-areas. In a first phase, the project's efforts focused on a qualitative analysis of a restricted number of indicators[82] and an investigation of the links/correlations between environmental and socio-economic indicators. The current

[80] www.teebweb.org notably chapter 3 of TEEB for Policy Makers

[81] See http://www.beyond-gdp.eu/

[82] "In-Stream indicators" include: GDP, Adjusted Net Savings (ANS), System of Integrated Environmental and Economic Accounting (SEEA-2003), EF, EMC, HANPP, LEP, Common bird index, Favourable Conservation Status (FCS), Marine Trophic Index (MTI), Red List Index, Potentially Disappeared Fraction (PDF), Energy intensity GDP GHG intensity, GDP Energy intensity, Per capita waste generation and energy from waste, Human Development Index (HDI), Happy Planet Index, National Accounts of Well-being.

phase of the project is concerned with the identification of the stages of the policy-making process in which environmental and socio-economic indicators are used to inform decision-making in a number of environmentally relevant policy-areas.

This questionnaire: A consultation of policy-makers active in a range of policy-areas was foreseen to support this work. Policy-makers' inputs will be key for the formulation of conclusions on the level of integration of environmental and socio-economic considerations through the use of indicators in different policy-areas, for producing recommendations with regard to the scope for the use of indicators in different policy areas and for the identification of persisting indicator gaps. To ensure the policy relevance of the project's findings, the work is being structured along three storylines, selected in light of current policy priorities: 'Biodiversity', 'Green growth' and 'Resource efficiency'. Policy areas have been grouped under the three storylines and they will structure the presentation of the project's findings. As a result, the focus on the policy-makers consultation will lie in particular on a selected number of policies: Biodiversity, Fisheries and Agriculture policies (under the 'Biodiversity' storyline); waste, products and natural resources policies (under the 'Resource efficiency' storyline), and Climate change and Cohesion policies (under the 'Green growth' storyline).

The **objective pursued in this consultation** is to better understand **which indicators are best suited for ensuring that sustainable development is reflected in the different policy-areas and at which stages of the policy-making processes are they best applied.**

The questionnaire therefore aims to gather information on:

d) Where **existing indicators** could be used better (different point in policy cycle, greater importance given to the evidence) or improved (better methodology, better data)

e) Which **new indicators** could complement the current list of IN-STREAM indicators known to be used in your policy area

f) Where **composite indicators** could have a role to play

Consultation process: We would be happy to schedule an appointment with you to discuss the questions over the phone (or in person if suitable). Alternatively, you can also send the completed questionnaire to lmazza@ieep.eu. If you decide to go for the latter option, we would welcome if you could do so no later than **24 January 2010** as we hope to be able to discuss some preliminary results at a first workshop in mid-February. Please note that not all of the questions may be applicable to your policy context – in this case please feel free to skip these.

Contacts:

Our contact: Leonardo Mazza - Policy Analyst, Institute for European Environmental Policy (IEEP)

E-mail: lmazza@ieep.eu

Direct line: +32 2 738 74 77

Please provide us with you contact details in the box below:

Your name, position and organisation:

E-mail:

Direct line:

We kindly thank you for your participation in this consultation. We will circulate the final results to all respondents.

As part of IN-STREAM a series of workshops to discuss the results of this consultation are planned in the first half of 2010. Should you wish to participate in one of the workshops listed below please send us an e-mail requesting that we add you to the list of participants, specifying which workshop you wish to attend.

*The first workshop will take place in **Brussels** on February 8-9, 2011 and will focus on use of sustainability indicators in the context of biodiversity policy and growth.*

Other workshops will be planned in due course, and are expected to take place in:

***Prague** – April 2011: Focus on Resource and Energy Efficiency*

***Berlin** – June/July 2011: Focus on Green Growth and Climate Change*

***Brussels** – final event - September/October 2011*

Should you be unable to respond to this consultation, we would welcome if you could help us identify another person we should contact.

Section 1: Scope for use of environmental and socio-economic indicators in [respondent's policy area]

When developing policy initiatives and/or monitoring the effects of their implementation you are likely to use a number of indicators, either directly related to the subject matter (e.g. improvement in environmental quality, more effective resource management) or to its corollary impacts (e.g. economic effects). As an individual, you might not be involved in all stages of the policy-making process, but are likely to be more heavily involved in some of these stages.

Figure 1 below provides an illustration of the different stages of the policy cycle and associated indicator needs. When filling out the questionnaire below, you will be asked to mention at which stage of the policy-making process the different indicators are used. Please refer to the red capital letters in the figure below to specify at which stage of the policy-making process you use specific indicators (e.g.: [A]; [H]).

Figure 1: *Overview of the different stages in which environmental and socio-economic indicators may be used in your policy area]*

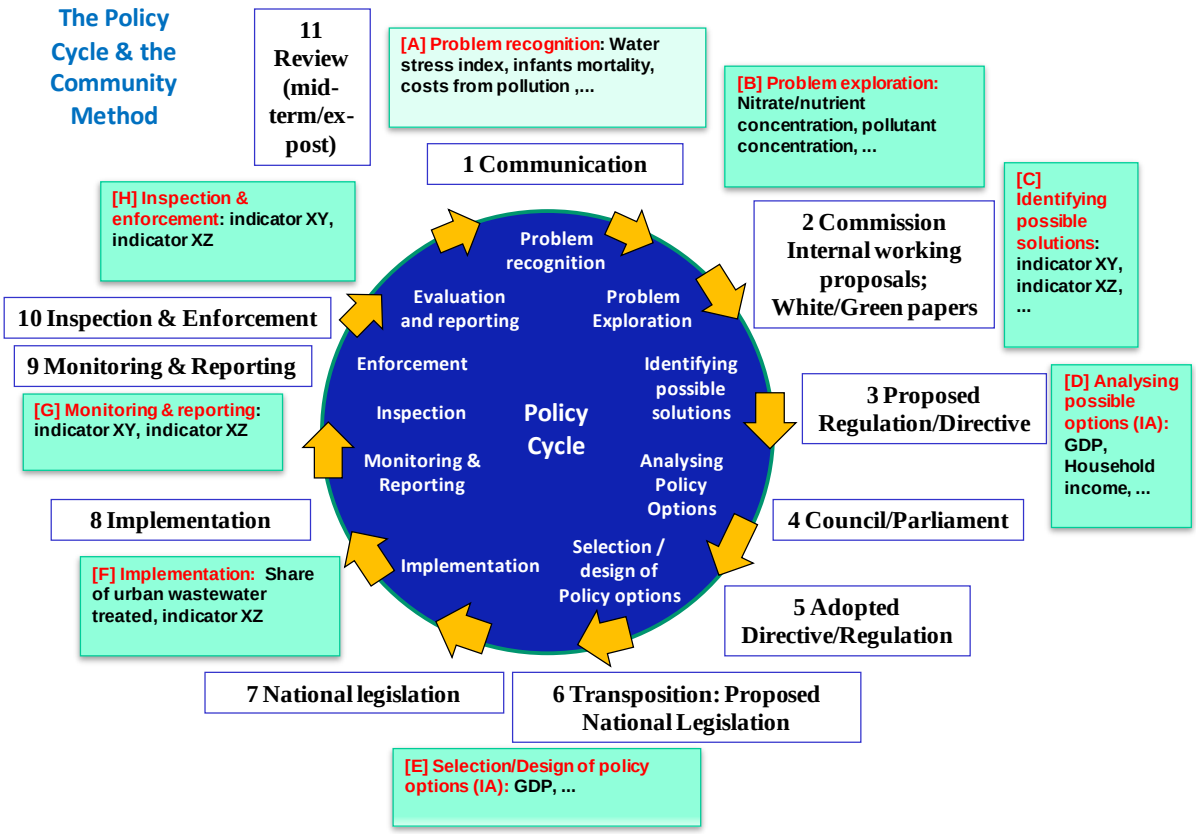

Table 1.1. Environmental indicators

The table below entails an overview of some of the main environmental indicators which could be of relevance at some stage of the policy-making process in your policy area. Please go through the indicators listed in the left hand column and complete the fields in the table below. Please note this is not meant to be an exhaustive list, and you can include additional indicators in the right hand side. Also note that some may not be applicable to your area, in this case just tick the 'no' box.

Environmental indicators	Questions
Composite environmental indicators (e.g. Ecological footprint, Human Appropriation of Net Primary Productivity (HANPP)*****, Adjusted net savings*****, Environmentally weighted Material Consumption* (EMC)*, Economy-wide Material Flow Analysis (EW-MFA).	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
State of nature & biodiversity (e.g. Common Bird Index*****, Red List*****, Potentially Disappeared Fraction (PDF)*****, Favourable conservation status*****, Marine trophic index*****; Invasive species)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Loss of natural areas (e.g. Annual increase in built-up areas, Forest fires, Change in extent of forest and other wooded wood)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Over-use of nature (e.g. Fish catches outside safe biological limits, Loss of soil quality reserves; Increase in intensification of agriculture)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please*

	indicate which one(s) and at which stage:
Ecosystem Service (ESS) indicators (e.g. Atmospheric cleansing capacity in tonnes of pollutants removed by hectare, Removal of nutrients by wetlands (tonnes or percentage), Regulation of water flows (infiltration capacity/rate of an ecosystem), Moderation of extreme weather events (Trends in number of damaging natural disasters), Amenities provided by the ecosystem or its components (Number of visitors to a site)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Climate Change (e.g. UNFCCC GHG emission including land use change, consumption of ozone depleting substances; GDP GHG intensity)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Energy (e.g. Energy consumption, Annual arising of nuclear waste/spent fuel, share of renewable energy in overall energy consumption)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Air pollution emissions (e.g. Emissions of nitrogen oxides, Emissions of PM2.5, Urban population exposure to air pollution by ozone/particulate matter)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Waste (e.g. Amount of waste generated per capita, Municipal waste generated, Amount of waste	**Do you use any of the indicators in the list: ☐ Yes ☐No**

landfilled/incinerated)	**If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Resources (e.g. Domestic Material Extraction, Domestic Material Consumption, Resource efficiency gains, Resource productivity; GDP Energy intensity;	**Do you use any of the indicators in the list:** ☐ **Yes** ☐**No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Transport (e.g. Freight transport volume (absolute and/or relative to GDP), total passenger transport, number of passenger cars, air passenger transport in EU 27)	**Do you use any of the indicators in the list:** ☐ **Yes** ☐**No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:

* IN-STREAM indicators

Table 1.2. Socio-economic indicators

The table below entails an overview of some of the main socio-economic indicators which could be of relevance at some stage of the policy-making process in your policy area. Please go through the indicators listed in the left hand column and complete the fields in the table below.

Socio-economic indicators	Questions
Composite indices*: (e.g. Human Development Index (HDI), Happy Planet Index, Wellbeing accounts, Inequality Index (i.e. Gini coefficient applied to GDP and Income)	**Do you use any of the indicators in the list:** ☐ **Yes** ☐**No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:

GDP (in its various forms: total, per capita, growth rate etc.); Net national Income; General Government debt	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Labour productivity	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Net investment in fixed capital; Value of built capital;	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Household income (in its various forms: total, per capita, growth rates etc.); Household saving rate; Comparative price levels (purchasing power)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Total Investment (e.g. in infrastructure; gross fixed capital formation (GFCF)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Gross domestic expenditure on	**Do you use any of the indicators in the list: ☐**

R&D; Innovation (e.g. patents)	**Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Employment/Unemployment-economic (including jobs created)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Employment - social (employment rate of older workers, gender, religion, ethnic and sexual orientation discrimination indicators)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
At-risk-of poverty rate after social transfer (by gender, total)	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Social: Healthy life years, Female/Male; Loss of life years; Disability adjusted life years	**Do you use any of the indicators in the list: ☐ Yes ☐No** **If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:
Life expectancy at birth, Female/	**Do you use any of the indicators in the list: ☐ Yes ☐No**

Male	**If yes, which one(s) (please also specify at which stage(s) (A-H) of the policy cycle):** *Should you use (an)other similar indicator(s) please indicate which one(s) and at which stage*:

* IN-STREAM indicators

2. Indicator gaps, lessons learnt and opportunities for improvement

The list of questions below starts out with rather specific questions and gets broader in the end. Please answer as many questions as you can.

2.1. Which are the top **three most influential indicators** in your policy area?

———

2.2. Do you know of an **indicator** which would **support policy-development and implementation relating to sustainable development** in your field which **currently is far from reaching its full potential?** (if this applies to more than one indicator please copy and paste the table for each one)

Name of the **indicator**	
What does the indicator measure and what is its **purpose**?	
The indicator is not reaching its full potential because:	☐ (a) not used at the most valuable point in the policy cycle ☐ (b) governance failure: the results are not integrated/listened to ☐ (c) it lacks robustness / needs development (method or data supporting it) ☐ (d) Other. Please specify:

At what **stage/stages of the policy cycle** is the indicator currently used? Could this indicator, in your view, also be used in other stages of the policy cycle? (see figure 1)	
Do you believe the use of this indicator has resulted in particular efforts to reduce adverse environmental impacts/ enhance environmental benefits?	
Please indicate the source of the data for this indicator	

2.3. Can you think of **an indicator** which would support sustainable development through policy-development and implementation in your field which **currently is not readily available for use**?

Name of the **indicator**	
What would the indicator measure and what would its **purpose** be?	
Why is the indicator currently not available for use?	☐ (a) it lacks robustness (method needs further improvement) ☐ (b)lack of data to support it ☐ (c) for political reasons ☐ (d) Other. Please specify:
At what **stage/stages of the policy cycle** could the indicator be used?	
Do you believe the use of this indicator could result in	

particular efforts to reduce adverse environmental impacts/ enhance environmental benefits, and if so where?	
Who do you expect to be **taking forward the development** of this indicator? (EU, Member States, Statistical offices, specific ministries etc.)	
Please indicate the potential sources of the data for this indicator, if known.	

2.4 Are you using an indicator for which there are different **methods for calculation?** If so, which one and would you support the development of a **commonly endorsed methodology**, possibly tailored to your policy area?

2.6 Are there specific areas in which you find the **number of indicators overwhelming** and would support the development of a **simplified composite indicator**?

2.7. Which indicator do you think would be most suitable for **communicating with the press/the media on sustainability related issues in your policy area**?

3. Ecosystem indicators and critical thresholds

3.1. Please name **ecosystem indicators** which would be of particular use in your policy area but have so far not been considered (sufficiently)?

3.2. Which are the **critical thresholds and resource limits** in your policy area? What indicators have been used, and has their consideration influenced policy outcomes?

4. Miscellanea

4.1 Do you see a need for reporting on the **level of cost recovery of natural resource use? If so,** and what indicators would allow you to set up a mechanism for cost recovery (e.g. water pricing; road pricing) and monitor its application?

4.2. Do you see scope/need for using wider **natural capital accounts and/or economic & environmental accounts (e.g. SEEA) and associated indicators** in your policy area?

4.3. Do you see scope for using the **Composite Index on Environmental Pressures**[83] currently under development at EC level in your policy area?

[83] Environmental index that reflects environmental pressure and that can be used in policy debates alongside GDP and social indicators, to indicate whether progress is being made on environmental goals. The index will be a pressure index and the percentage by which the index decreases against a previous year could be interpreted as the 'growth rate of environmental protection'.

Useful links regarding indicators

Eurostat indicators

- Sustainable Development

  http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators

- Climate Change and Energy

  http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators/theme6

- Natural resources

  http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators/theme8

- Sustainable Transport

  http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators/theme7

Indicators for the measurement of Ecosystem Services

TEEB for Policy Makers Draft Chapter 3: Strengthening indicators and accounting systems for natural capital: www.teebweb.org/LinkClick.aspx?fileticket=J3_lcRRutGw%3d&tabid=1019&language=en-US

SEBI 2010 – List of Biodiversity Indicators

http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/sebi_full.pdf

Beyond GDP indices and indicators that have been developed/ are being used

Adjusted net savings (Genuine Savings) and Wealth of Nations
Calvert-Henderson Quality of Life Indicators (USA)
Canadian Index of Well-Being
Composite Learning Index
Ecological Footprint
European Commission environment-related indicators
European Environment Agency's Core Set of Indicators
Environmental Performance Index and related Environmental Performance Measurement Project
European Values Survey

EU Lisbon Strategy, structural indicators
EU sustainable development indicators
Genuine Progress Indicator
Happiness
Happy Planet Index
Human Development Index (reports, UN)
Human Development Index (HDI), Human Poverty Index (HPI), Gender Related Development Index (GDI), Gender Empowerment Measure (GEM)
Sustainable Society Index
Index of Sustainable Economic Welfare (ISEW)
Living Planet Index
Measure of Domestic Progress (NEF)
Natural Capital Index
Sustainable National Income (SNI)
Umwelt-Barometer Deutschland