

**FINAL REPORT  
FEBRUARY 2000**

**A REVIEW OF INDICATORS  
OF SUSTAINABLE DEVELOPMENT:**

**A REPORT FOR SCOTTISH ENTERPRISE TAYSIDE**

**Tony Jackson & Peter Roberts**

Geddes Centre for Planning Research  
School of Town and Regional Planning  
University of Dundee  
Perth Road, Dundee DD1 4HT  
tel: 01382 345239  
fax: 01382 204234  
e-mail: [a.a.jackson@dundee.ac.uk](mailto:a.a.jackson@dundee.ac.uk)

Copyright: Scottish Enterprise Tayside 2000

Not to be quoted directly without prior permission of the authors and Scottish Enterprise Tayside

## CONTENTS

	<b>Page Nos</b>
<b>EXECUTIVE SUMMARY</b>	3
<b>Part 1 INTRODUCTION</b>	10
1.1 Objectives of Study	10
1.2 Terms of Reference for Study	10
<b>Part 2 THE CONCEPT OF INDICATORS OF SUSTAINABLE DEVELOPMENT</b>	11
2.1 The Theoretical Background	11
2.2 Sustainable Development: the New Paradigm	13
2.3 The Development of Models of Indicators of Sustainable Development	17
2.4 Illustrative Examples of the Application of Sustainability Indicator Models to Policy Evaluation	23
<b>Part 3 EXAMPLES OF THE APPLICATION OF INDICATORS OF SUSTAINABLE DEVELOPMENT AT DIFFERENT LEVELS OF DECISION-MAKING</b>	30
3.1 Scope of Chapter	30
3.2 International Applications	30
3.3 National Applications	39
3.4 Regional and Local Government Initiatives	43
3.5 Community Initiatives	48
3.6 Corporate Initiatives	53
<b>Part 4 RECOMMENDATIONS FOR THE DEVELOPMENT AND IMPLEMENTATION OF OPERATIONAL INDICATORS FOR LOCAL DEVELOPMENT AGENCIES</b>	57
4.1 The Current Scottish Enterprise Context	57
4.2 The Suggested Approach	72
4.3 Criteria for the Selection of Indicators	72
4.4 A 'Long List' of Indicators	74
4.5 Developing the Influenceable Indicators	76
4.6 Using the Indicators	77
4.7 Conclusions	83
<b>BIBLIOGRAPHY</b>	84

## Executive Summary

### 1. Introduction

This study considers:

- the background to, and evolution of, indicators of sustainable development;
- examples of indicators used at various levels of government;
- suitable possible indicators for use by Scottish Enterprise Tayside (SET).

### 2. The Concept of Indicators of Sustainable Development

#### *The Theoretical Background*

Short-term added-value project appraisal measurements have traditionally been used to calculate the net benefits of development for the community. However, this approach has serious limitations as a means of delivering sustained real improvements in the quality of life, which operate within the carrying capacity of the environment: ie sustainable development.

Measures of progress need to consider implications for social justice and the environment, as well as promoting responsible economic progress. Sustainable development offers a new model which fulfils these requirements. 'Weak' sustainability, which asserts that it is possible to improve both material well-being and environmental quality through appropriate development strategies, epitomises the current approach taken by the World Bank, OECD, EU and UK. In the form of 'ecological modernisation', this reflects a belief that, instead of a zero-sum trade-off between the environment and the economy, continued economic prosperity and improvements in living standards are dependent on the promotion of higher environment standards.

On this basis, adoption of sustainable development as a goal, and the use of indicators of sustainable development to measure progress towards this goal, should enhance current performance measures and generate better development pathways. There is no evidence that it will detract from the effectiveness of development agencies engaged in these tasks.

#### *Development of Models of Sustainable Development Indicators*

The initial development of indicators focused on measurement of environmental status and changes in this. This is insufficient as a basis for measuring performance in the delivery of sustainable development. The original 'pressure-state-response' ('p-s-r') model was driven purely by environmental considerations.

Environmental Kuznets Curves (EKC) suggest that environmental status degrades during the initial stages of economic development, but then improves because the detrimental impact of increased scale of activity on the environment is increasingly offset by the improved composition of this activity (more services, less heavy industry), and the use of clean technology. 'Tunnelling through the EKC' offers a strategy of transferring lean, clean technology to nations entering the most environmentally damaging stages of economic growth.

Social indicators provide the third element of sustainability measures. The United Nations Development Programme Human Development Index (HDI) uses life expectancy, education and

living standards to construct an index with which to gauge the progress of nations. However, the HDI focuses on averages within nations rather than inter-personal and small group differences, something which the parallel UN 'Capability Poverty Measure' (CPM) is designed to counteract. The CPM focuses on the proportion of a nation's population suffering inadequate health (measured by the proportion of underweight under-fives), inadequate access to health services (unattended births), and education and gender inequalities (adult illiterate females). This index seeks to measure poverty on a 'people-centred' basis.

Neither of the UN approaches is capable of reflecting differences in levels of social inclusion between nations with comparable high average standards of living. Alternative measures are required to this end, which focus on the extent to which a nation's institutions allow its citizens to be brought into social processes, decision-making and participation in the life of the community.

### *Contrasting Examples of the Application of Models of Sustainable Development*

The Dutch National Environmental Policy Plan (NEPP) uses indices of indicators of the state of the environment, based on six environmental themes, to construct an aggregate index to measure progress in attaining environmental objectives. Although valuable as a practical illustration of environmental performance measures, this approach suffers as a management tool in not offering a comprehensive assessment of overall progress towards sustainable development and failing to offer any guidance on cost-effective methods of achieving environmental improvements.

The World Bank 'genuine-savings' model addresses the issue from a different perspective, focusing on the necessary conditions for sustainable development: a non-negative level of net investment in reproducible and environmental assets. Using published national accounts data, national savings ratios are compared with depreciation allowances for reproducible capital and estimates of depletion of environmental capital to provide a test of the capacity of a nation's economy to deliver sustainable development. Only those nations generating sufficient savings to maintain the overall stock of reproducible and environmental capital can be said to be on a sustainable development pathway. On this measure, the UK emerges as marginally sustainable, with a development pathway inferior to most other EU Member States.

### **3. The Application of Indicators of Sustainable Development at Different Levels of Decision-Making**

#### *International Applications*

Much of the effort at this level has been focused on supplementary measures of development that can be used in conjunction with the United Nations System of National Accounts. These include the establishment of a System of Integrated Environmental and Economic Accounting, and a United Nations Committee on Sustainable Development working list of indicators. For the latter, the environmental p-s-r model has been adapted to the needs of sustainable development by replacing the concept of pressures with the term 'driving-force indicators'; these reflect those human activities that impact on sustainable development, either in a harmful or beneficial way.

The United Nations work on indicators is principally directed towards the needs of the nation state, although encouragement is given to the development of lower tier indicators. Similar work is being undertaken by the OECD, which has adapted its own p-s-r model to focus on sustainable development amongst its member states. This work is currently being tested by a number of member states and is used in OECD analytical work and environmental programme reviews. The

OECD's aim is to develop environmental indicators in ways which evaluate progress towards sustainable development. This is to be achieved by tracking environmental progress, and integrating this more effectively into sectoral and economic policies. In this way, the inter-relationships between environmental and economic policies can be more effectively identified and evaluated. Social aspects of sustainability remain a relatively neglected aspect of the OECD's work.

European Union initiatives largely parallel UN and OECD research. The European Commission programme consists of three elements: an environmental pressure indicators programme; development of EU indicators based on the UNCSO work using Agenda 21; and a number of projects under the EU general research programme. Social indicators are based on key statistics, such as population density, migration, health, unemployment, urbanisation etc., rather than measures of social inclusion. This reflects the p-s-r approach to modelling.

### *National Applications*

Following publication of the UK Strategy for Sustainable Development, an inter-departmental government working party on indicators produced an initial report, in which indicators were selected to translate the concept of sustainable development into four quantifiable aims: a healthy economy protecting the quality of life, human health and the environment; optimal use of non-renewable resources; sustainable use of renewable resources; and minimisation of the risk of damage to environmental carrying capacity, human health, and biodiversity. The initial exercise grouped potential indicators into twenty-one 'families' covering different aspects of sustainability, using a p-s-r framework which was extended to cover economic and social aspects.

More recently, the Department of the Environment, Transport and the Regions (DETR) has produced a set of 'headline' indicators of sustainable development which increase the emphasis on measures of social inclusion. These indicators have attracted some criticism that they unduly simplify the relationships within which relevant policies have to be framed. The headline indicators have been followed by a revised strategy for sustainable development and a more detailed set of indicators incorporating these revisions.

Other initiatives at a Scottish level and in the United States take a more detailed look at such relationships, deriving indicators from social and environmental accounting matrices based on input-output analysis. A further variant of this accounting approach is the creation of an Index of Sustainable Economic Welfare (ISEW), which forms the basis for the US 'Genuine Progress Indicators' (GPIs). This type of index is intended to reflect environmental and distributive criteria not considered by standard procedures. The results suggest that the use of GDP per head leads to over-estimates of improvements in the quality of life. Critics of this approach have pointed to the arbitrary nature of many of the adjustments made.

### *Regional and Local Government Initiatives*

In response to Local Agenda 21 (LA21), many sub-national tiers of government have developed indicators of sustainable development, to serve as an educational tool, a technical assessment of baseline environmental status, and a measure of performance in delivering sustainability. In the UK, local government has attempted to combine the introduction of environmental management systems with the application of indicators as performance measures.

Such work has progressed more rapidly in an urban context than in rural areas, with urban authorities applying indicators in the preparation of plans and strategies. Databases suitable for rural indicators are less in evidence, and standard measures of social deprivation tend to have an urban bias. One conclusion to be drawn from work on rural aspects of sustainability is that addressing the problem of social disadvantage by promoting a greater uptake of individual benefits is less productive than using a pro-active set of measures to create more sustainable rural communities.

### *Community Initiatives*

Community indicator initiatives range from metropolitan to rural in scale and reflect great diversity, although the guidance provided for LA21 offers a degree of commonality within the UK. It has argued that preference should be given to the use of indicators as measures of performance in the delivery of sustainability targets, over their use at this level for educational or technical purposes. Against this, interesting work is being undertaken on aspects of community planning, including community sustainability auditing and community-based partnerships for the delivery of local public services. The Association of London Government has developed a methodology for assessing the degree of civic engagement by its constituents.

### *Corporate Initiatives*

The use of corporate monitoring indicators pre-dates the concept of sustainable development. However, few organisations are yet able to measure all their environmentally-related impacts, and even fewer consider their social obligations. Current debate centres on the distinction between 'eco-balancing' (objective evaluation of total environmental impacts) and 'eco-controlling' (management-driven rules for incremental environmental improvements). There is also a gradual switch from compliance with external obligations towards the delivery of internal management objectives, focused on 'win-win' concepts of 'eco-efficiency'.

Some of the more promising corporate initiatives are being undertaken by development agencies and partnerships charged with delivering programmes of selective spatial assistance. These include the partnerships set up to deliver Structural Funds regional assistance, the Scottish Enterprise network (SEN), and the English Regional Development Agencies.

## **4. Operational Indicators of Sustainable Development for Development Agencies**

### *The Current Scottish Enterprise Context*

Indicators of sustainable development are recognised in advice to the Scottish Executive as an integral part of public monitoring information. Efforts are being made to integrate the use of such indicators into the new strategy being promoted by SEN. The strategy is based around four development goals for the Scottish economy: innovative, far-sighted organisations; positive attitudes towards learning and enterprise; an inclusive economy; and a competitive place.

Although these goals are not incompatible with the pursuit of sustainable development, progress still needs to be made to extend the traditional framework of assessment away from an emphasis purely on short-term economic targets, and towards a broader concern with long-term sustainable environmental, social and economic development pathways. Guidance is required in this respect. The tracking process being applied to the Scottish economy by SEN uses a set of national

performance baselines in conjunction with international comparisons and with measures for monitoring progress towards the four strategic goals.

A parallel system for monitoring the impact of the network's own activities is being created to complement this tracking system. Some progress is being made in introducing measures of sustainability within this monitoring system, but the present approach towards performance measurement within SEN still remains heavily dependent on quantifiable output measures which are predominantly economic. The intention is that sustainability should be incorporated at the level of project appraisal and picked up through subsequent evaluation.

Guidance on ways in which sustainability can be integrated into the overall management of development programmes is provided by the Bellagio Principles. These set out procedures for translating sustainability into managed programmes organised around four stages: a mission statement; systematic assessment of operational programmes in terms of their sustainability; delivery of key aspects of openness, effective communication and broad participation in the contents of the programme; and the capacity to evaluate and report on progress to this end. Indicators are seen as playing a central role in this process.

### *The Suggested Approach*

Our recommendations attempt to distil the lessons of the analysis undertaken on the development of suitable indicators of sustainable development at various levels of decision-making, and on the management framework being applied within SEN.

In terms of performance measurement, indicators of sustainable development must stress the need for:

- an explicit set of categories linking vision and goals to indicators and assessment criteria;
- a limited number of key issues for analysis;
- a limited number of indicators of progress;
- standardised measurement;
- indicators related to the spatial context;
- ongoing assessment integrated into the decision-making process.

In a Scottish context, this suggests that two levels of management are involved, requiring two sets of indicators:

- *contextual indicators*, enabling the attainment of broadly agreed strategic objectives to be monitored for their impact on sustainable development objectives, where these involve co-operation with partners engaged in the provision of development assistance; such indicators need to be developed in consultation with these partners;
- *influenceable indicators*, applied specifically to monitor and measure the performance of SEN's (and specifically SET) programmes in delivering sustainable development objectives which are under its influence, including the performance of 'client' organisations.

A long list of both types of indicators is provided, from which short lists can be selected as appropriate, based on the desired characteristics for such indicators as management tools: clarity; specificity; effectiveness; relevance; balance; longevity. The indicators applied should permit a

flow in decision-making from a strategic concern with the four goals, through contextual indicators, influenceable indicators, specific SET performance measures, and finally down to project specific measures. Two further criteria should be applied in the selection of indicators: consideration of the extent to which these reflect a policy action or activity that can be influenced by or attributed to SET; and consideration of the extent to which SET can ensure that the selected indicators will be accepted by its partners in development.

### *Developing and Using the Influenceable Indicators*

Once a final list has been selected from a range of influenceable indicators, elaboration of the chosen set is required. Examples are offered of the processes involved. It is proposed that SET should set a context for each indicator that will enable a client organisation or individual to develop and agree specific performance targets, indicate how such targets may be measured, and illustrate the contribution to SET's performance.

The indicators chosen will reflect many of the inherent contradictions in assessing progress towards sustainable development, but this should not be used as an excuse for avoiding their application. The contextual indicators can be used to guide SET's contributions to:

- a range of partnership initiatives from local to national level;
- general programmes at regional, local and neighbourhood level;
- overall national performance;
- reporting SET's contributions and performance.

The influenceable indicators can be used to measure SET's contributions and activities including:

- influencing partner organisations;
- influencing the behaviour of individual firms and other institutional clients;
- influencing and training individual persons;
- conducting appraisals of applications for financial and other forms of assistance and in relation to other project proposals;
- contributing to general social and environmental welfare;
- assessing and reporting on SET's performance at all levels: national, regional and local.

In addition to these specific measures that are related to SET's use of the indicators, the overall effect of using the indicators can be assessed. However, this will require SET to collaborate with other partner organisations in the design and operation of an agreed assessment framework. Community Planning will have an important role to play in this respect as a form of corporate territorial planning and management. While contextual indicators will require close agreement between partners, influenceable indicators can be selected primarily by SET. A good starting point would be for SET to set an example by identifying and implementing a package of influenceable indicators along with specific targets/measures that can be applied to its own operations and activities.

## *Conclusions*

Preparing and implementing indicators of sustainable development are important tasks. It is essential to be able to measure progress towards the attainment of the objectives of sustainable development, in order better to manage the process. Two types or levels of indicator are required:

- contextual - these monitor the attainment of broadly agreed strategic objectives and will be established in co-operation with national, regional and local partners;
- influenceable - these monitor the progress of Scottish Enterprise/SET programmes and the achievement of individual 'client' organisations.

It is important that Scottish Enterprise/SET set the pace and standard of behaviour with regard to the delivery of sustainable development. This can best be achieved by developing and adopting suitable indicators of sustainable development.

## **PART 1: INTRODUCTION**

### **1.1 Objectives of Study**

This report is in three parts. In Part Two we review the theoretical underpinnings of the concept of sustainable development and of the indicators proposed for measuring progress towards this objective.

This entails a brief survey of various models and approaches that have been applied to this field of research, which is illustrated by examples of the different types of indicators which stem from such work. Following on from this, we then examine (Part Three) how such indicators have been developed and applied at various levels of decision-making, from those developed on an international basis, to national systems, and local and community approaches, together with sectoral and corporate initiatives. In Part Four, we draw together and apply the lessons from the previous chapters in order to provide guidance on the way in which indicators of sustainable development can be used by agencies charged with promoting local development.

Economic development agencies work closely with the corporate sector and are also charged with a broader range of responsibility for community development. These responsibilities include both the development of human resources within their area and a general recognition of the need to promote the interests of the community in which they operate and of its physical, social and economic environment in ways which sustain that community. The indicators we have recommended as deserving consideration are tailored to the needs of development agencies operating with these broader aims in mind.

### **1.2 Terms of Reference for Study**

This study provides an initial review and assessment of sustainable development and how it can be applied to the operation and measurement of economic development policy. In particular the study examines:

- the background to, and evolution of, indicators of sustainable development - this suggests the need to review the basis of policy development and the linkage between the various levels of government;
- some examples of indicators that have been applied at various levels of government - this provides a basis for selecting indicators suitable for use by SET;
- suitable possible indicators for use by SET.

## **PART 2: THE CONCEPT OF INDICATORS OF SUSTAINABLE DEVELOPMENT**

### **2.1 The Theoretical Background**

#### *Conventional Approaches to the Assessment of Development*

Until recently, the most widely accepted method of assessing the contribution of policies, programmes and projects to the welfare of a community relied on the calculation of the 'added-value' obtained from these interventions. 'Added-value' is a concept at the heart of social cost-benefit analysis. It stems directly from the work undertaken in the 1950s and 1960s by Simon Kuznets and Paul Samuelson to provide an analytical framework which allowed microeconomic measurements of welfare changes created by individual initiatives to be directly related to macroeconomic measurements of national or regional output, principally through the use of national or regional accounts. Their research provided a sound methodological basis for asserting that a social cost-benefit assessment which could demonstrate a 'potential Pareto improvement' (ie that the present value of aggregate benefits exceeded the present value of aggregate costs) could be translated into a general improvement in the welfare of the community.

Used in this context, 'added-value' is not simply operating profit. Properly measured, it quantifies the change in social utility created by initiatives. In practice, however, the theoretical rigour of this approach has been undermined by the use of simplifying procedures both at microeconomic level (in which hard to quantify non-direct costs and benefits are ignored) and at macroeconomic level (which sees the Standard System of National Accounts bypass central tenets of social utility when selecting and quantifying readily measurable forms of output). The Scottish Enterprise Output Measurement Framework (Jackson 1998), although praiseworthy as an attempt to provide a comprehensive monitoring, reporting and measurement system over a wide range of interventions, provides a good example of this simplified and analytically naive approach. The limitation on appraisal created by reliance on what are crude assessments of value added is evident in the retention within the OMF of two ancillary objectives to which the primary measurement cannot be guaranteed to do adequate justice: employment and productivity.

Furthermore, the Kuznets/Samuelson methodology deliberately eschewed questions of equity and conservation of resources. The limitations of adopting an interpretation measured purely in terms of economic efficiency were readily apparent to those concerned with the environmental and social impacts of the generation and distribution of added value. Additional concepts of 'added value' emerged related, for example, to improvements in social welfare, educational attainment and environmental conditions. Thus, even in the 1960s many social and environmental issues were identified in attempts to develop indicators of development.

#### *The Development of Alternative Measures*

The 1970s saw the beginnings of a reaction against the simplistic application of social cost-benefit methodology to the evaluation of policy, programme and project initiatives. This reaction came from at least two directions. Firstly, there was growing concern that the techniques were being employed to justify decisions taken for reasons of expediency. A key aspect of the debate centred on the Roskill Commission which was set up in 1968 to evaluate alternative sites for London's Third Airport. The attention focused on cost-benefit procedures at this inquiry revealed the paucity of an analytical framework capable of coping adequately only with passenger and traffic movements and their associated costs, and highlighted the inadequacy of techniques for evaluating environmental impacts.

The general discontent with the outcome of the Roskill inquiry amongst both decision-makers and the academic community dissuaded Government from more frequent recourse to a pseudo-scientific 'black-box' approach to sensitive major investment appraisals.

The second form of attack manifested itself in the form of a general rejection of the philosophy of 'tonnage ideology' that associated progress with higher levels of material outputs, regardless of the consequences (Jackson & Roberts 1997). In particular, the rejection of 'tonnage ideology' coincided with the desire of governments at all levels to utilise limited public financial resources to achieve multiple objectives using the same funding package. The attempt to decouple quality of life from material flows of resources can be traced back both to critics of an over-dependence on standard national accounting systems, and to the rising importance of environmentalism as a counter to materialism.

Anderson (1991) offers a clear illustration of both strands. His discussion of alternative economic indicators provides a straightforward critique of the current quantification procedures used to measure the value of national output and the use of this as a proxy for changes in welfare. It identifies the failure to include an allowance for the depletion of environmental capital which is compounded by the inclusion of added value attributed to measures to tackle pollution and waste. It points to the inability of national accounts to cope with improvements in welfare which do not generate tangible increases in physical output (such as the reduction in the working week), and the total absence of any distributional considerations with respect to the consumption of outputs. It then argues the case for the use of alternative indicators, which offer parallel ways of describing economic processes:

- " the economy considered from a monetary or *financial* point of view (which is the one emphasised by present-day economics);
- the economy considered as consisting of *human* beings organised together in particular ways;  
and
- the economy considered as a set of arrangements for mediating the relationship between human beings and the *natural* world" (Anderson 1991, p.46).

On this basis, Anderson argues that conventional indicators of economic performance can only provide insights into the first way of describing the economic process, and that we require new indicators to describe the impact of economic processes on humans and between humans and the environment. The criteria which are suggested for identifying good indicators to this end are listed in **Table 2.1**.

**Table 2.1: Seven criteria for selecting ‘good indicators’ (Anderson 1991, pp.49-51)**

{PRIVATE } Criterion	Explanation
<b>1. Ease of availability</b>	The indicator itself, or the information from which it is calculated, should already be available, or can be made available easily and cheaply
<b>2. Ease of understanding</b>	The indicator should be relatively easy to understand
<b>3. Measurability</b>	To be relevant, the indicator must relate to a measurable entity rather than a concept
<b>4. Significance</b>	The indicator should measure something believed to be important, or should reflect or represent something of significance
<b>5. Speed of availability</b>	There should be little delay between the element being measured and the availability of the data on this
<b>6. Pattern of incidence</b>	The indicator should be able to utilise spatial and social information so that a picture of relative incidence rather than simply aggregate impacts is available
<b>7. Comparability</b>	Ideally, international comparisons should be possible through the use of appropriate indicators, but those chosen should not be selected purely to simplify international comparisons at the expense of other objectives

## 2.2 Sustainable Development: the New Paradigm

For such criticisms to produce changes, it is insufficient to expose the shortcomings of the conventional methodology. The key step is to provide an acceptable alternative paradigm which supports these alternative indicators. Sustainable development has succeeded in fulfilling this function. The Brundtland definition:

"development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987, p.43)

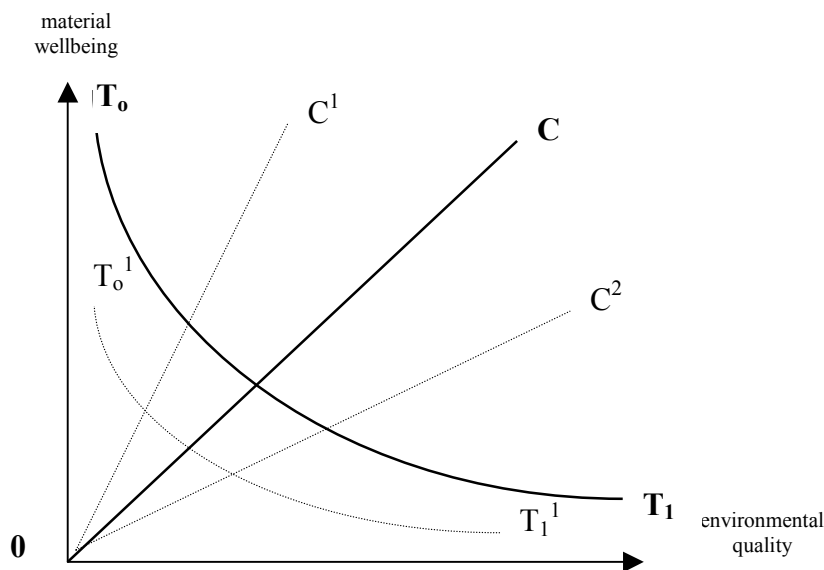
has proved acceptable both to the critics of the conventional approaches for assessing development and to the advocates of environmentalism. Brundtland allowed environmental concerns to be set clearly within the context of poverty and development, albeit from the perspective of international under-development:

“It is impossible to separate economic development issues from environmental issues; many forms of development erode the environmental resources upon which they must be based, and environmental degradation can undermine economic development. Poverty is a major cause and effect of global environmental problems. It is therefore futile to attempt to deal with environmental problems without a broader perspective that encompasses the factors underlying world poverty and international inequality" (*ibid.*, p.30).

Nevertheless, while providing a framework to reconstitute the issues to be addressed, the general adoption of the goal of sustainable development as a replacement for that of economic growth has not fully resolved the debate about the objectives of development. Instead, it has shifted its focus on to the meaning of the term sustainable development. In the view of a leading authority, the absence of an agreed ideological framework has stunted progress towards identifying appropriate decision rules and practices at an operational level:

"Most writings on sustainable development start from scratch and so proceed to get things hopelessly wrong. It would be hard to find another field of research endeavour in the social sciences that has displayed such intellectual regress" (Dasgupta 1995, p.116).

**Figure 2.1: Strong and weak interpretations of sustainable development** (after Pearce et al 1989)



**Figure 2.1** offers a theoretical model of the difference between what has come to be termed the ‘strong’ and the ‘weak’ schools of sustainability. Strong sustainability, represented by the deep green environmentalist position, identifies the need to preserve a critical stock of natural resources or environmental capital as the primary goal, with failure in this respect compromising all other goals. The carrying capacity of the earth must therefore take precedence over other considerations, given that the scope for substituting non-environmental capital for such stocks is considered negligible. The ecological interpretation of sustainability offered by Daly (eg Daly 1977), or a belief that the driving forces of environmentalism have been hijacked by corporate interests (Welford 1997) is bound up with this approach to sustainable development which views the preservation of the earth's carrying capacity as a zero-sum trade-off with improvements in material wellbeing.

This position is represented by the function  $T_0-T_1$  in **Figure 2.1**, which implies that an improvement in environmental quality is achievable only at the expense of living standards. A failure to promote environmental sustainability, moreover, will eventually lead to a collapse in the earth's carrying capacity and inexorably lead to a collapse in material standards of living. This ‘doomsday’ scenario can be represented by a pathway which shifts the trade-off function nearer the origin if environmental quality is allowed to decline below minimal levels of carrying capacity, as illustrated by the dotted curve  $T_0'-T_1'$ .

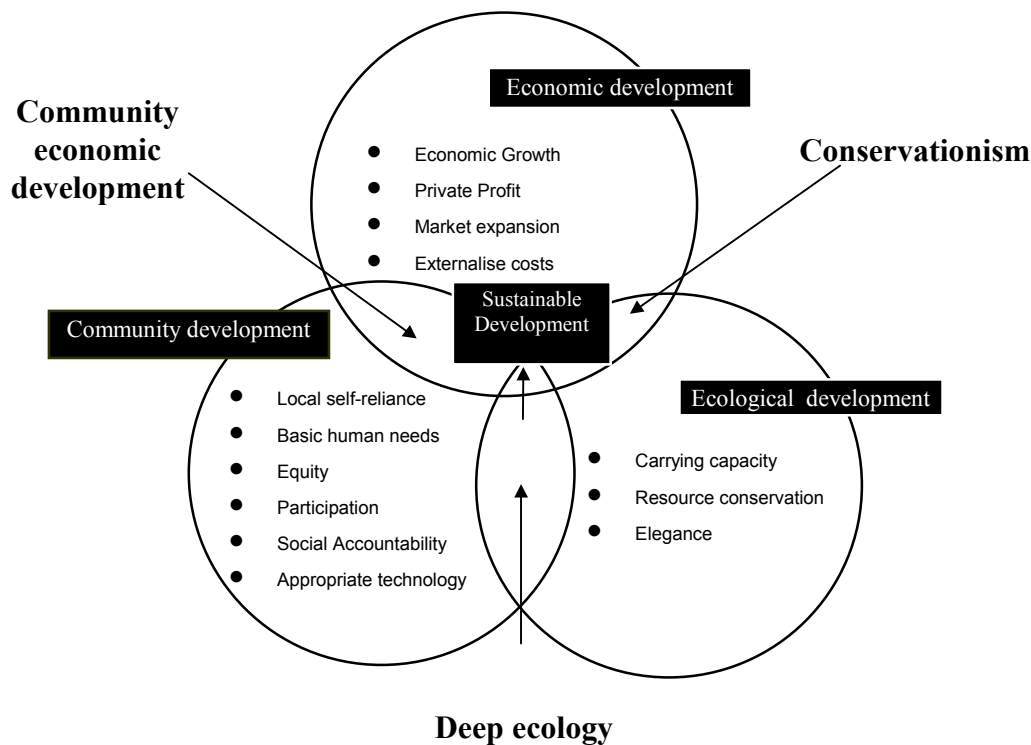
By contrast, the theoretical framework for weak sustainability supported by the light green advocates of environmentalism is represented by the vector  $O-C$  in **Figure 2.1**. This asserts that it is possible to

improve both material levels of wellbeing and environmental quality through judicious selection of development strategies. Fundamental to this position is the belief that extensive substitution is possible between environmental and reproducible forms of capital, sufficient to offset continued reductions in finite (non-renewable) stocks of environmental assets produced by ongoing development. This view is most clearly stressed both in the Brundtland Report and in the World Bank Report produced for the 1992 Earth Summit (World Bank 1992). It is encapsulated in the United Nations Environment Programme definition of sustainable development which has provided the basis for the development of indicators under the Local Agenda 21 initiative:

"development which improves the people's quality of life, within the carrying capacity of the earth's life support system" (World Conservation Union et al 1991, p.10).

Given this interpretation of sustainable development, there is no longer a zero-sum trade-off between environmental standards and material wellbeing. A failure to take into account the environmental and social aspects of economic growth can still result in a movement along a trade-off curve such as  $T_0-T_1$  in **Figure 2.1**, but the selection and implementation of appropriate strategies can instead create a pathway such as **O-C** along which complementary improvements in material wellbeing and in environmental quality can be realised. The slope of the actual pathway capable of achieving sustainable development depends on the effectiveness with which the issues are addressed, and the scope available to substitute sustainable for non-sustainable systems of resource use, as indicated by the alternative dotted vectors from the origin in **Figure 2.1**. Seen in this light, the essence of the task is to determine the optimal sustainable pathway along which to steer development, which is an issue of dynamic planning.

**Figure 2.2: The overlapping zones of interest within the weak interpretation of sustainable development represented by 'ecological modernisation' (Pinfield 1997)**



Hajer (1996) applies the term 'ecological modernisation' to this interpretation of sustainable development. Ecological modernisation is founded on the principle that the attainment of high environmental standards is a precondition for sustainable long term improvements in material wellbeing. This view of sustainable development underpins the European Union's Fifth Environmental Action Programme (CEC 1992). It has also begun to permeate the appraisal, monitoring and evaluation mechanisms of the EU's Structural Funds, which provide the principal means by which the EU promotes spatial and social cohesion (Jackson & Roberts 1999).

The acceptance, espoused in the EU Fifth EAP, that sustainable improvements in environmental standards and material wellbeing are mutually dependent, and that sustainability must originate from a bottom-up adoption of policies, programmes and projects which implement this pathway, is given tangible form by an EU requirement for both 'vertical' and 'horizontal' social and environmental measures in all EU-funded programmes. 'Vertical' measures focus on specific sectoral projects intended to deliver impacts at all spatial levels. 'Horizontal' measures concentrate on bringing together the separate elements of all EU programmes at a given spatial level. **Figure 2.2** provides a view of the characteristic overlapping zones of interest which epitomise this interpretation of a sustainable development pathway. An essential element of this pathway is the recognition that the characteristics of places vary considerably and that policies, indicators and methods of evaluation should recognise this spatial distinctiveness (Roberts, 1995).

Uncertainty over whether the new paradigm requires adherence to a 'strong' or 'weak' interpretation of sustainability has been the source of much of the confusion in developing appropriate indicators to measure performance in this field. The adoption of the ecological modernisation version of the sustainability paradigm by Member States of the EU, by the OECD, the World Bank and the UN Commission on Sustainable Development, offers pragmatic support for choosing this as the basis for selecting the policies, programmes and projects, along with the appropriate indicators capable of providing the evaluative framework, in seeking to implement sustainable development.

The course to be steered along an ecological modernisation pathway is considerably more complex than the requirements for 'strong' sustainability, and the indicators required must reflect this. As **Figure 2.1** indicates, the optimal pathway operates in several dimensions. In developing such a pathway, it must be possible to distinguish between sustainable and unsustainable practices in terms of:

- actions at any one time which may lead to improvements in one element of sustainable development (environmental, social or economic) at the expense of another, from actions which lead to improvements in at least one of these areas without compromising any other;
- pathways which involve actions over time which can only realise improvements in one element of sustainable development at the expense of another, from pathways which satisfy all the elements of sustainability;
- actions at any one time and over time which may lead to improvements sectorally or spatially in sustainable development only at the costs of creating unsustainable impacts on other sectors or areas, from sectoral or spatial actions which offer overall progress in sustainable development.

In practice, most actions and pathways will involve some improvements in some aspects sustainability at the expense of adverse impacts elsewhere: sectorally, spatially or over time. Moreover, the optimal

pathway could involve choices which violate one or more of the elements of sustainability for certain sections of society, employed in certain activities and living in certain areas, in order to make the paradigm shift towards a more sustainable use of resources. This would be the case, for example, if the emphasis on energy efficiency and a move towards renewable sources of energy resulted in closure of inefficient sources of energy production or usage.

Under such circumstances, the procedures applied in social cost-benefit analysis offer some guidance. The Kaldor-Hicks criterion argues that it is sufficient to be able to show that the losers can be compensated by the gainers, and that an initiative offers a potential Pareto improvement in welfare (ie that redistribution could offer the possibility that some are better off and no-one worse off). Unfortunately, the K/H criterion is not invulnerable to criticisms which focus on the need to make compensatory payments in order to avoid ambiguous outcomes. This is especially pertinent in dealing with environmental resources for which, once made, choices are not in many cases readily reversible, and the alternative pathways are no longer available. It is equally critical to the social choices involved in sustainability, which are determined more by distributional rather than efficiency considerations.

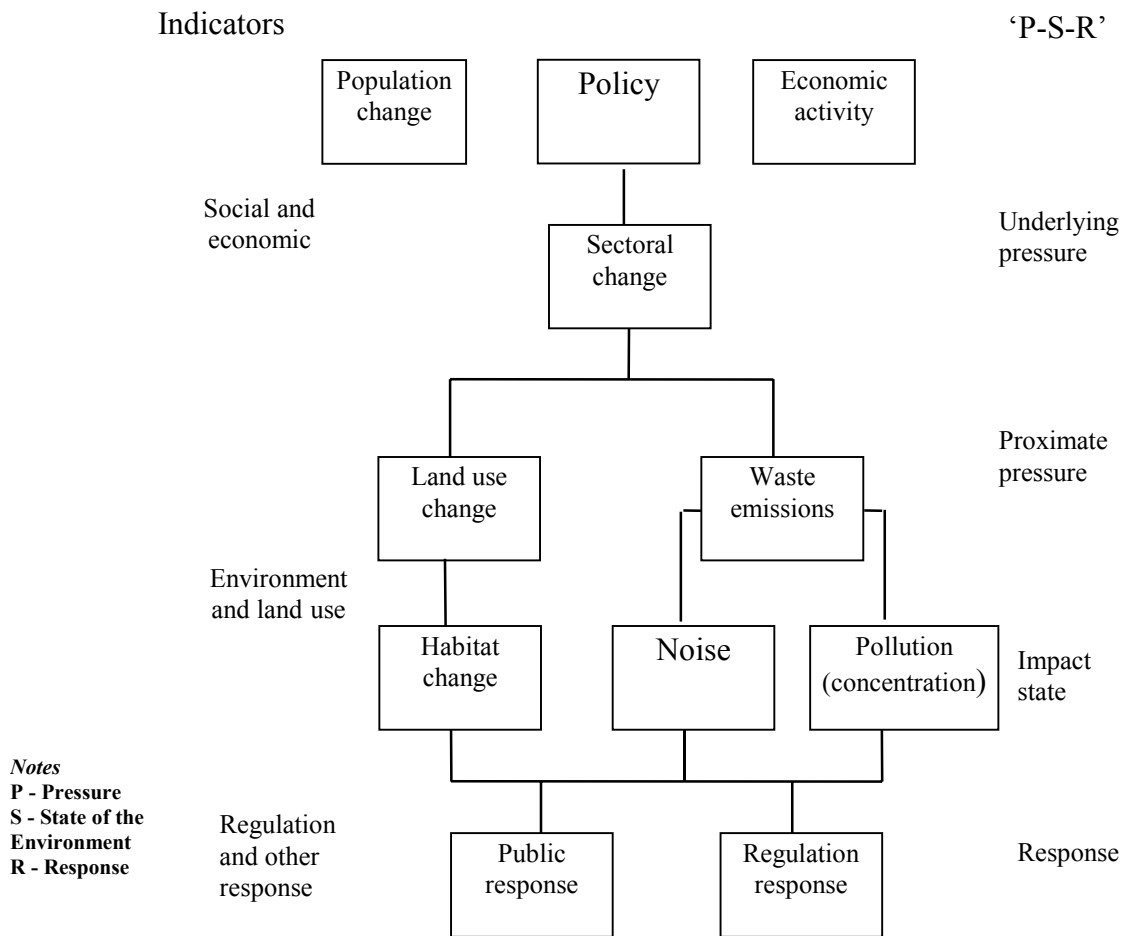
All this serves to confirm that sustainable development is a difficult strategy to master and to identify as having been mastered through the use of indicators (even the much simpler criteria needed to establish economic growth offer plenty of room for dispute). Nevertheless, it also confirms the crucial part which indicators of sustainable development must play. The following section provides a review of the state of play in this respect.

### **2.3 The Development of Models of Indicators of Sustainable Development**

#### *The Pressure-State-Response Model*

Indicators of environmental performance provide a test for the achievement of environmental sustainability and by extension fulfil the tests required of strong sustainability. However, because they ignore social-economic considerations, such indicators can only offer a necessary rather than a sufficient test of the ecological modernisation interpretation of sustainable development. For this reason attempts to develop indicators of sustainable development based on a model of environmental impacts, represent a continued source of confusion. Nevertheless, environmental indicators offer a starting point for many of the attempts to develop suitable indicators for the broader concepts of sustainable development, and a brief review of such developments provides a helpful introduction to the general methodological issues involved.

**Figure 2.3: A basic model of environmental indicators (OECD 1994)**



One of the best known methodological frameworks using environmental indicators has been developed by the Organisation for Economic Co-operation and Development (OECD 1994, OECD 1998). **Figure 2.3** illustrates the 'pressure-state-response' model pioneered by the OECD. The selection of indicators able to monitor each of these elements is based on a listing of desirable characteristics for environmental indicators reproduced as **Table 2.2**, which may be compared with Anderson's list in **Table 2.1**. The key aspect of these criteria is the matter of analytical soundness. It is not clear that the use of the "pressure-state-response" model is applicable to the ecological modernisation interpretation of sustainable development. As **Figure 2.3** suggests, the model underpinning the OECD approach is purely driven by environmental considerations. Socio-economic elements only enter as sources of pressure on, or regulatory and other responses to, environmental states.

**Table 2.2: OECD criteria for the selection of environmental indicators\*** (OECD 1994, p.10)

{PRIVATE } Criterion	Explanation
<b>Policy relevance and utility for users</b>	An environmental indicator should: <ul style="list-style-type: none"> <li>- provide a representative picture of environmental conditions, pressures on the environment or society's responses;</li> <li>- be simple, easy to interpret and able to show trends over time;</li> <li>- be responsive to changes in the environment and related human activities;</li> <li>- provide a basis for international comparisons;</li> <li>- be either national in scope or applicable to regional environmental issues of national significance;</li> <li>- have a threshold or reference value against which to compare it, so that users are able to assess the significance of the values associated with it.</li> </ul>
<b>Analytical soundness</b>	An environmental indicator should: <ul style="list-style-type: none"> <li>- be theoretically well founded in technical and scientific terms;</li> <li>- be based on international standards and international consensus about its validity;</li> <li>- lend itself to being linked to economic models, forecasting and information systems.</li> </ul>
<b>Measurability</b>	The data required to support the indicator should be: <ul style="list-style-type: none"> <li>- readily available or made available at a reasonable cost/benefit ratio;</li> <li>- adequately documented and of known quality;</li> <li>- updated at regular intervals in accordance with reliable procedures.</li> </ul>

*\* these criteria describe the 'ideal' indicator and not all of them will be met in practice*

The model suggests that underlying pressures, such as population change, economic growth and policy decisions, produce changes in sectors of activity which create proximate pressures on the capacity of the environment to meet demands on it, identifiable in terms of changes in land use or waste emissions. Proximate pressures then produce impacts on the current state of the environment, which are measured in terms of changes in habitat, noise, ambient levels of pollution, and concentrations of waste in the environment. In turn, such impacts will generate a variety of responses, which normally result in some modification of underlying or proximate pressures at national, sectoral, community or individual levels. The 'pressure-state-response' model has been extended to encompass socio-economic factors, as for example in the UK Indicators of Sustainable Development (Department of the Environment, 1996). The capacity of such a model to deal with the broader aims of sustainable development is assessed in the next part of our report.

### *Environmental Kuznets Curves (EKC's)*

Another interesting example of the extension of environmental indicators to the assessment of sustainable development is provided by the development of 'environmental Kuznets curves' (World Bank 1992, Grossman 1995). EKC's originate from the work pioneered by Simon Kuznets to plot the relationship between changes in national income per head and economic variables such as consumption, investment and savings, in aggregate terms across different nations and over time.

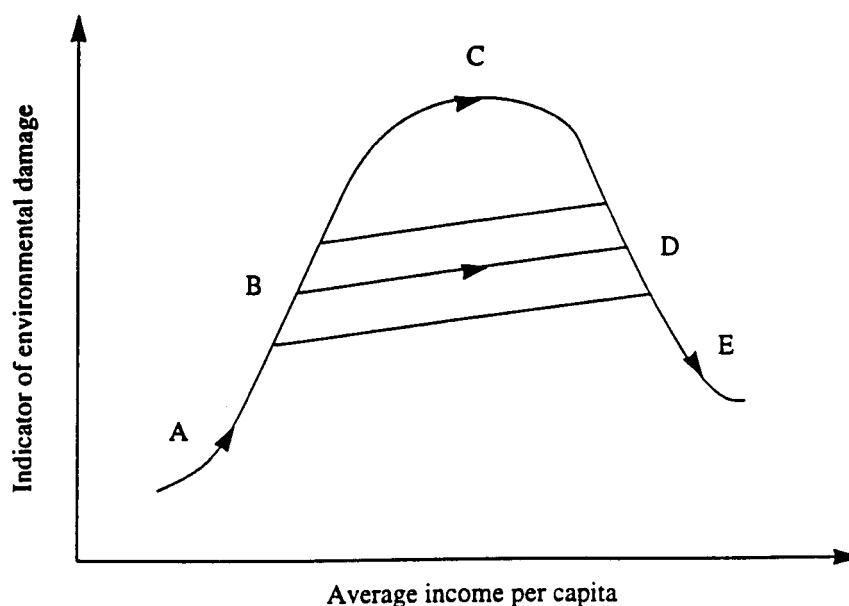
Taking increases in real national income per head as a proxy for economic growth, it is possible to regress such data against indicators of environmental states or flows, and to use this to identify relationships between types of environmental damage and economic growth. For a wide range of environmental indicators an inverted 'U' or bell-shaped relationship can be derived, as **Figure 2.4**

illustrates. Grossman (1995) attributes this shape, which suggests that levels (or rates of change - the distinct is important but often elided) of environmental damage initially rise during the initial stages of economic growth and decline thereafter, to the inter-action of three economic processes of change:

- *the scale of economic activity.* Increasing levels of output - scale effects - are directly associated with higher levels of adverse environmental impacts in the form of waste emissions and pollution. If other factors did not change, EKC's could be expected to show a linear positive relationship with economic growth, depicting steadily increasing environmental damage as the scale of economic activity rose.
- *the composition of economic activity.* Part of the process of economic development involved changes on the composition of output as well as its scale. Changes in composition will offset some of the scale effects. As living standards rise, the economy will move from reliance on heavy manufacturing and extractive industry with the most detrimental environmental effects, to lighter manufacturing and service sector activity. Even without changes in technology, this modification of the composition of output would reduce the adverse impact of economic growth on the environment.
- *the technology used for economic activity.* Improved technology will lead to cleaner and leaner production, even for heavy extractive and manufacturing activities, reducing their impact on the environment. The effects of such changes in input-output coefficients can be of orders of magnitude in certain sectors (eg information technology). In addition, at higher income levels, consumers are able and willing to pay more for a cleaner environment (ie the environment becomes an income-elastic good in its own right).

Taking all these factors together, advocates of bell-shaped EKC's (of which the World Bank is pre-eminent) argue that changes in the composition of economic activity along with the use of better technology increasingly offset and in many cases outweigh the scale effects of economic growth. The application of policies founded on ecological modernisation, and the increasing use of technology transfer, offers the added possibility of 'tunnelling through the EKC', as **Figure 2.4** demonstrates.

**Figure 2.4: Tunnelling through a bell-shaped Environmental Kuznets Curve** (Atkinson et al 1997)



Nevertheless, the model of development on which EKC are based does not in itself provide a solution to the questions posed by sustainable development. Evidence for the existence of EKC with respect to environmental indicators is patchy (Grossman 1995). Some indicators reveal such a shape, others do not. Moreover, if as is normally the case EKC are plotted in terms of rates of emission of pollutants rather than changes in ambient levels, a fall in emission rates can only be tied unambiguously to a reduction in ambient levels by assuming that environmental sinks can cope with current rates of emission and ambient levels. Common (1995) has cogently argued that over the very long term the tenets of strong sustainability require not simply that the positive relationship between pollutants and economic growth declines, but that it vanishes completely.

### *Social Indicators*

Models which attempt to relate economic growth to environmental standards, such as the P-S-R and EKC approaches, are defective as instruments for measuring progress in sustainable development unless they also incorporate some means of assessing social progress towards sustainability. This remains a relatively neglected aspect of the search for indicators of sustainable development at national level, although useful work has been undertaken in this respect both by the United Nations and by local communities seeking to implement LA21.

The UNDP Human Development Index (HDI) is based on three key components of basic human development:

- longevity
- knowledge
- living standards (Moldan 1997).

Under this approach, life expectancy at birth as a proportion of a maximum value (85 years) is used to calculate longevity. The state of knowledge is calculated as a weighted average of the proportion of adults in the population who are literate and the proportion of those of school age attending classes. Living standards are expressed as a proportion of purchasing-power adjusted GDP per head using a logarithmic scale (in which incomes above a threshold level of PPP\$5,711 - the average world income

- are subject to discounting, while those below are not).

These three indicators are then combined into an overall HDI, in which each element contributes a third of the total. The 1996 HDI ranked Canada at the top, followed by USA, Japan, Netherlands and Norway, with the UK placed 16th. The ranking can be compared with that using purely PPP-adjusted GDP per head. Canada is six places, and the UK seven places, higher on the HDI than on the GDP ranks, which suggests that when social indicators are included these nations offer a better lifestyle than their crude output per head performance indicates. On this basis, it has been argued (Bartelmus 1994) that the maintenance of non-declining HDI is a better test of sustainability than the maintenance of a stock of non-declining reproducible and environmental capital (see following section). However, even with an adjustment for the declining utility of income, the HDI has been criticised both for using averages which mask distributional problems and shifts in the proportions of those in any community having access to such standards, and for using income-based economic indicators rather than measures of social achievement.

In response to such criticisms, the UN agency responsible for the HDI has developed a parallel "Capability Poverty Measure" (CPM), which utilises Amartya Sen's work on people's capacity to lead worthwhile lives as a measure of poverty (McKinley, 1997). Under the CPM, the capacity to enjoy basic opportunities for personal development is seen as the end-product of human development, and deprivation is measured by the lack of basic capabilities in this respect. This index differs from the HDI in focusing on people's lack of attainment rather than on average attainments. It also avoids confusion between ends and means by excluding income as a measure of human development.

The CPM is a simple composite index that uses the unweighted arithmetic mean of three indicators:

- proportion of children under five who are under-weight;
- proportion of women aged fifteen and over who are illiterate;
- proportion of births unattended by trained health personnel.

These indicators have been chosen as the most practicable for gauging general health amongst the population (under-weight children); access to reproductive health services and overall health services (unattended births); and basic educational attainment plus gender inequalities (adult illiterate females). Given the availability of suitable databases they could be supplemented with additional such information, but the key element in the CPM is its focus on the deprivation of basic human capabilities. As such, the CPM seeks to measure poverty on a "people-centred" basis, as distinct from a needs-based access approach (ie lack of access to assets, facilities and services, such as clean water, schools, jobs, etc.)

Social indicators of sustainable development which attempt to focus on personal capabilities rather than needs or income suffer from limited information. Equally, however, the HDI as a measure of the prerequisites for human development is of limited value once such prerequisites have been broadly attained. The HDI can offer little guidance on the social elements of sustainability for developed market economies in the OECD, for example, in which rates of literacy, life expectancy and income levels, although not perfect, are far more uniform than between such nations and the rest of the world. Despite the possession of similar levels of material goods and services for their people, few with experience of these nations would argue that in social terms they presented a uniform group. For such nations, social indicators need to find more sophisticated measures of the social quality of life. MacGillivray (1997) defines such an objective as:

"the ability of people to work together for common purposes in groups and organisations" (p.256).

MacGillivray applies the term "social capital" to this concept, arguing that this includes:

"features of social organisation, such as networks, norms and social trust, that facilitate co-ordination and co-operation for mutual benefit" (p.256).

This concept is distinct from the traditional definition of social capital used, for example, by the recently published DETR headline indicators of sustainable development (Department for the Environment, Transport and the Regions 1998a), which applies the term 'social investment' to cover publicly funded assets such as schools and hospitals.

Following MacGillivray's usage, social capital is a measure of the "inclusiveness" of any society, the extent to which it brings the members of its society into social processes, decision-making and participation in the life of the community. Adequate measurements of social capital, so defined, are rare, and their interpretation is still open to debate (they are sensitive to major cultural differences, for example). Nevertheless, this approach matches the stance taken in Agenda 21, which devotes three chapters to these aspects:

- integrating environment and development in decision-making (ch.8);
- providing education, public awareness and training (Ch.36);
- information for decision-making (Ch.40).

There is also a whole section in Agenda 21 on the need for participation by major groups of society (section three). As MacGillivray observes:

"Without indicators to show whether and how these groups are involved in decision-making, there is a risk that sustainable development will remain a task for government and experts, and will thus fail. High levels of social capital are a precondition for sustainable societies" (p.257).

Although still in its early stages, research on indicators to this end is utilising membership of voluntary organisations as a measure of social inclusiveness and civic engagement. The LGMB Sustainability Indicators Project (see below, Chapter 3) included "empowerment" and "culture and recreation" amongst its suggested themes (see Table 3.4). Many of the UK local authorities which have adopted LA21 have established participatory sustainability panels and fora. In other OECD countries, such as Canada, the concept of "community sustainability auditing" is being promoted (see below, Chapter 3).

McGillivray suggests that social indicators of sustainability should focus on two key areas of social development:

- information for decision-making;
- institutions that take part in decision-making for sustainable development.

An indicator for the first area is provided by data on newspaper readership. Although correlated to some extent with levels of literacy, rates of readership still vary significantly between nations with similar levels of literacy and economic performance, reflecting differences in the degree of public involvement in the decision-making process. Given the recent explosive growth in the internet, data on this may also serve the same purpose.

"Third sector" NGO activities offer a readily accessible measure of voluntary involvement in decision-making processes. However, although research is improving our understanding of such activities, the lack of a consistent database makes comparisons difficult, even within a single country. The participation of NGOs at UN level in sustainability fora should lead to improvements in this respect.

## **2.4 Illustrative examples of the application of sustainable indicator models in policy evaluation**

The remainder of this part of the report reviews two attempts to monitor performance with respect to sustainable development. These approach the issue from opposite directions, and in consequence use indicators which are very different. The first uses an aggregate index of environmental damage as a means of assessing the effectiveness of government policies with respect to sustainable development. The second adapts current measures of economic performance to provide a simple test of weak sustainability. The examples are deliberately chosen to illustrate the wide scope for adopting different approaches to such tasks.

### *The Netherlands National Environmental Policy Plan (NEPP)*

The Dutch National Environmental Policy Plan (NEPP) uses environmental indicators to assess the effectiveness of a set of predetermined policies aimed at implementing sustainable development (Adriaanse 1993). The policies are the outcome of a systematic attempt to tackle the effects of environmental degradation. They incorporate the polluter-pays principle, and place heavy reliance on economic instruments rather than command-and-control regulations. They are based on self-regulation and negotiated agreements amongst target groups and actors, leaving it to local initiatives to produce proposals which contribute to the targets.

At the centre of the NEPP are a set of aggregate indicators of environmental performance, chosen as the means of assessing the effectiveness of the plan. They are constructed around six environmental themes:

- climate change
- acidification
- eutrophication
- dispersion of undesirable substances
- disposal of solid waste
- disturbance from odour and noise.
- 

**Table 2.3** illustrates the two-stage process in creating the performance indicator for climate change. The top half of the table calculates the global warming potential of various greenhouse gases, based on the carbon dioxide equivalent (Ceq) in terms of persistence and warming impact. When applied to the greenhouse gases, this permits equivalent measures of emissions for each source and the summation of total emissions, as indicated by the bottom half of the table for the period 1980-91.

**Table 2.3: Calculation of impacts of one of the NEPP environmental themes: climate change** (Adriaanse 1993)

#### **a. Global warming potential (GWP) conversion factors for greenhouse gases**

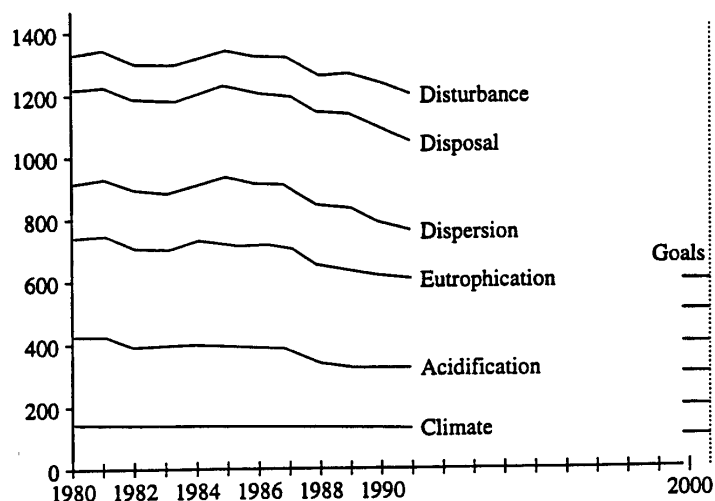
<b>{PRIVATE }Substance</b>	<b>GWP Factor</b>
CO <sub>2</sub>	1
CH <sub>4</sub>	12
N <sub>2</sub> O	290
CFC-11	3,500
CFC-12	7,300
CFC-113	4,200
CFC-114	6,900
CFC-115	6,900
Halon-1211	5,800
Halon-1301	5,800

**b. Actual emission of greenhouse gases in the Netherlands, converted to million tonnes Carbon equivalent (Ceq)**

{PRIVA TE } Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CFC+Halon	Total
1980	172.000	10.320	11.600	92.369	286
1981	165.000	10.423	11.600	92.000	279
1982	152.000	10.527	11.600	91.500	266
1983	152.000	10.633	11.600	89.500	264
1984	161.000	10.739	11.600	85.800	270
1985	166.000	10.846	11.600	82.000	271
1986	170.000	10.955	11.600	72.760	265
1987	177.000	11.064	11.600	59.792	260
1988	180.000	11.175	11.600	49.141	252
1989	182.000	11.287	11.600	40.816	246
1990	186.000	11.400	11.600	34.811	244
1991	185.000	11.514	11.600	31.132	239

The novel aspect of the NEPP performance measures is that for each theme an index is constructed of the resulting environmental indicator, and these are then summed to provide an overall index of performance, as illustrated by **Figure 2.5**. The target for cumulative index is 600 (ie 100 per indicator), and the current emission levels are expressed in terms of this target. On this basis, it can be seen that the cumulative index peaked at 1,346 in 1985, more than double the NEPP target. By the start of the NEPP, which covers the period 1992-2000, the aggregate index had fallen to 1,195, so that the NEPP had to halve aggregate emissions over the period to fulfil its objectives. Eutrophication and the disposal of solid waste present the toughest challenges.

**Figure 2.5: An environmental pressure index for the Netherlands (Adriaanse 1993)**



Although novel, the Dutch approach leaves a number of critical issues unresolved. Firstly, there is no attempt to justify the choice of environmental indicators. The six chosen themes are weighted equally. There is no overt means of reconciling a greater reduction in one performance indicator with a weaker performance (or even a deterioration) in another. By aggregating the index, it is implicitly assumed that weak performance in one theme can be offset by a strong performance in another, measured in terms of physical quantities of emission. This implies a very specific type of substitution between

environmental impacts which would generally not hold true for all but minor adjustments.

Although the NEPP is said to rely on economic instruments to achieve its targets, no thought appears to have been given to the measurement of the relative marginal costs of improvements in each of these indicators, so as to compile a strategy capable of achieving the greatest aggregate reduction in emissions at the lowest aggregate cost. More generally, the concept of an 'optimal' level of abatement, in which targets are set to match costs with benefits, is absent. Whatever the weaknesses of a cost-benefit approach such as BATNEEC, it represents a less arbitrary commitment of resources to the plan than the assumption of unitary rates of substitution between physical emission levels.

### *Green National Accounts and Real Savings Ratios*

Atkinson et al (1997) offer an elegant and simple test of the sustainability of an economy. This is based on a weak interpretation of sustainable development in which the state of the environment is subsumed as a necessary condition for the maintenance of human wellbeing into the indefinite future. It employs data on national accounts to reveal whether economies are on a sustainable development path. By extension, if it can be shown that economies cannot fulfil even the weak requirement for sustainability it follows that they are even less likely to be able to meet the strong requirement. This model is a response to the perceived shortcomings of those based on extension of the OECD pressure-state-response use of environmental indicators, as the following extract makes clear:

"While many currently-used indices represent useful summaries of the state of the environment, it is evident that their interpretation as measures of sustainable development is less clear. For example, policy-maker information is contingent upon our understanding of what sustainable development means - that is, non-declining human wellbeing over time. A minimal condition for supposing that development will be sustained is that a nation's capital assets should be at least maintained - this argues for attention to be paid to indicators of natural assets and changes in these assets" (p.31).

Atkinson et al (1997), illustrate that it is possible to undertake some manipulation of information on standard national accounts so as to incorporate allowances not just for the depreciation of reproducible capital (the using up of assets created by humans which offer a stream of income over their lifetime, an allowance for which is required in all national accounts) but also for the depletion of environmental capital (which is not a current requirement for the UN system of national accounts). Using the maintenance of both types of capital asset as a test of weak sustainability, Atkinson et al (1997) then examine sets of national accounts modified to include environmental as well as reproducible capital, to determine whether the savings ratio (the proportion of national income not consumed and available for investment to replace used up capital) is greater or smaller than the consumption of both types of capital assets. Economies which pass this test of sustainability have savings ratios which exceed the amounts required to replace the depreciation of reproducible and depletion of environmental capital. While it does not follow that economies which pass this test are necessarily pursuing sustainable pathways, it is improbable that economies which fail such a test can meet any of the interpretations of sustainability. So this approach offers a valuable filtering mechanism as well as a test of the capacity of an economy to deliver sustainable development.

Figure 2.6: Sustainable and non-sustainable savings ratios (Atkinson et al 1997)

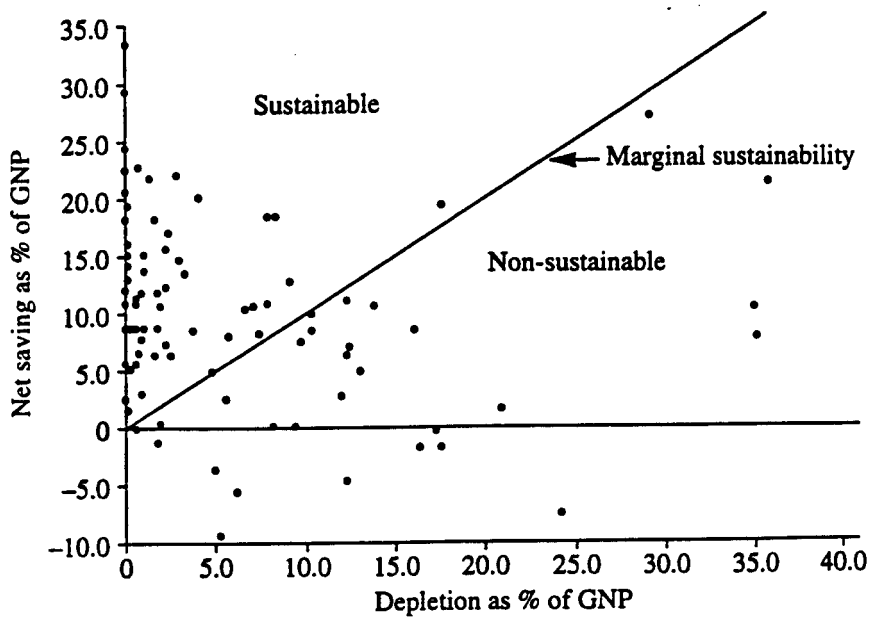


Figure 2.6 illustrates the results of such an exercise. The vertical axis measures net savings within an economy in the conventional sense, ie gross savings minus depreciation of reproducible capital assets. Clearly in those economies with negative net savings it will not be possible to pursue a sustainable pathway: not only are they setting aside nothing to replace depleted environmental capital, they are allowing their reproducible capital to run down. Such economies will appear in that part of the graph below the zero line on the vertical axis. More significantly, this approach identifies a large number of economies with net savings which are not sufficient to cover the depletion of their environmental capital, even though they are capable of meeting the depreciation of their reproducible capital stock. Such economies are shown on the graph as falling below the vector drawn through the origin which plots points that equate net savings with environmental depletion, ie a 5% net savings ratio with a 5% depletion of environmental capital, each measured as a percentage of GNP. Anything below this vector indicates that the economy is unsustainable at present: its net savings are insufficient to replace or substitute for its current level of depletion of environmental capital. Economies on the vector are marginally sustainable on this test, while only those above the vector meet the weak test of sustainability, in that they are not using up ('living off') their capital assets, but are generating sufficient savings to be able to maintain their assets for the indefinite future.

**Table 2.4: The "real savings" test for sustainable development (Perman et al 1996, p.64)**

{PRIVATE }National economy	Test calculation*			
	S/Y	-dM/Y	-dN/Y	=Z
<b>Sustainable economies:</b>				
Brazil	20	7	10	+3
Costa Rica	26	3	8	+15
Czechoslovakia	30	10	7	+13
Finland	28	15	2	+11
Germany (west)	26	12	4	+10
Hungary	26	10	5	+11
Japan	33	14	2	+17
Netherlands	25	10	1	+14
Poland	30	11	3	+10
USA	18	12	3	+3
Zimbabwe	24	10	5	+9
<b>Marginally sustainable:</b>				
Mexico	24	12	12	0
Philippines	15	11	4	0
United Kingdom	18	12	6	0
<b>Unsustainable:</b>				
Burkina Faso	2	1	10	-9
Ethiopia	3	1	9	-7
Indonesia	20	5	17	-2
Madagascar	8	1	16	-9
Malawi	8	7	4	-3
Mali	-4	4	6	-14
Nigeria	15	3	17	-5
Papua New Guinea	15	9	7	-1

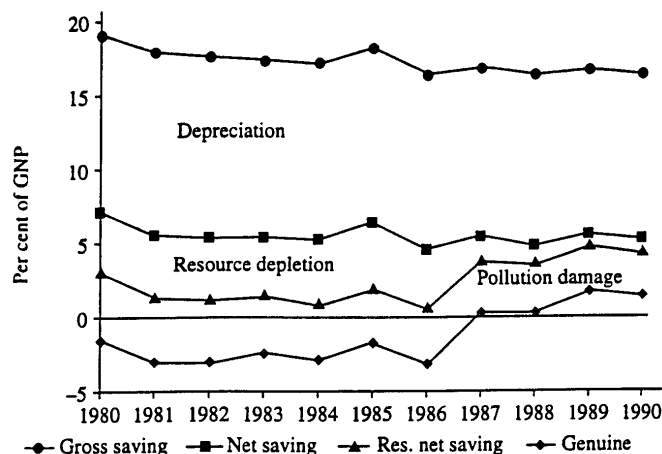
\*An economy is sustainable if it saves more than the depreciation on its man-made and natural capital, ie Z is greater or equal to zero.

S = Gross Domestic Savings dM = Value of depreciation of man-made capital  
Y = Gross Domestic Product dN = Value of depreciation of natural capital  
Z = Sustainability index

The data in **Figure 2.6** are derived from a set of 56 developing countries for which complete time series exist for the period 1980 to 1990 (see Atkinson et al 1997, pp.97-98). **Table 2.4** indicates the outcome of the same test when applied to a range of developed and developing economies. As can be seen, while all the unsustainable economies on this test are low-income developing nations, the UK appears amongst the marginally sustainable economies. Its 'Z' score (equivalent to the real savings ratio after all sources of capital usage are taken into account) is zero, ie gross savings are just equal to depreciation of reproducible capital and depletion of environmental assets.

The poor performance of the UK on this test is a reflection of its reliance on the extraction of North Sea hydro-carbon energy to provide a significant part of its national income during the 1980s. Current national accounts take such production as value added, without making any allowance for the depletion of reserves, thus artificially boosting UK growth rates and national income per head. **Figure 2.7** illustrates that despite a gross savings ratio of between 15% and 20% of GNP, after allowance is made for each type of asset deprecation or depletion, the genuine savings ratio for the UK was negative for most of the 1980s, and only became positive towards the end of the decade. This shift back onto a potentially sustainable pathway was, however, not the outcome of deliberate policy measures to promote sustainable development, but an accident of the market for energy. The fall in the world price for oil meant that oil extraction formed a smaller part of the output of the UK economy!

**Figure 2.7: United Kingdom savings rates, 1980-1990** (Atkinson et al 1997)



**Table 2.5** uses this test to compare the performance of the UK economy with other EU Member States. The improvement in the position of the Netherlands would appear to suggest that progress had been made before the introduction of the NEPP, although one of the reasons for the improvement in Dutch real savings is its switch from heavy reliance on extraction of hydrocarbon reserves, which characterised the 1970s and early 1980s. On this measure, the UK is placed towards the bottom of the EU scale in terms of its capacity to achieve sustainable development.

**Table 2.5: Genuine saving as a percentage of GDP amongst EU Member States and other western European nations** (Atkinson et al 1997, p.93)

{PRIVATE } Country	1980	1985	1990
Austria	11.4	8.8	13.1
Belgium	7.2	5.7	11.9
Luxembourg	8.4	10.3	15.6
Denmark	4.7	7.7	11.5
Finland	5.4	7.3	8.2
France	11.4	5.2	7.9
Germany	8.1	7.5	13.8
Greece	4.1	-3.4	-2.8
Ireland	-3.3	6.3	14.2
Italy	7.5	6.6	7.4
Netherlands	6.0	5.4	13.3
Norway	13.4	5.0	8.5
Portugal	-4.2	3.0	4.4
Spain	4.8	3.4	9.2
Switzerland	2.5	7.3	8.3
UK	-1.6	-1.7	1.4

Further work on this approach by the World Bank (World Bank 1997) has been critically assessed by Neumayer (1999). This indicates that the concept of “genuine” savings, coined by the World Bank to indicate a level of national investment sufficient to maintain the stock of reproducible and natural assets over time (ie the Z score in **Table 2.4**), is a valid indicator of the capacity of any economy to attain weak sustainability. However, Neumayer’s work also draws attention to the sensitivity of such measurements to various assumptions about what to count as investment and how the depletion of non-renewable natural resources is calculated (Neumayer 1999, ch.5).

## **PART 3: EXAMPLES OF THE APPLICATION OF INDICATORS OF SUSTAINABLE DEVELOPMENT AT DIFFERENT LEVELS OF DECISION-MAKING**

### **3.1 Scope of Chapter**

This part of our report provides brief reviews of the application of various types of indicators of sustainable development at different spatial and sectoral levels: international, national, regional and local, community and corporate. In conjunction with the previous part, which considered the theoretical underpinnings of sustainable development and the use of indicators, the evidence from this part will provide the foundation for our proposals on the application of indicators for local and regional development agencies in general, and SET in particular, which are set out in the final part of our report.

### **3.2 International Applications**

Much of the effort at international level to develop indicators of sustainable development has been focused on the provision of supplementary measures of development, that can be applied in conjunction with the United Nations System of National Accounts (UNSNA). A number of important theoretical and practical advances have been made in this field during the past decade (eg Freeman 1993, Gray et al 1993, Hamilton 1994, Hartwick 1990, Maeler 1991, Moldan et al 1997, Pearce & Atkinson 1993).

#### *United Nations Initiatives*

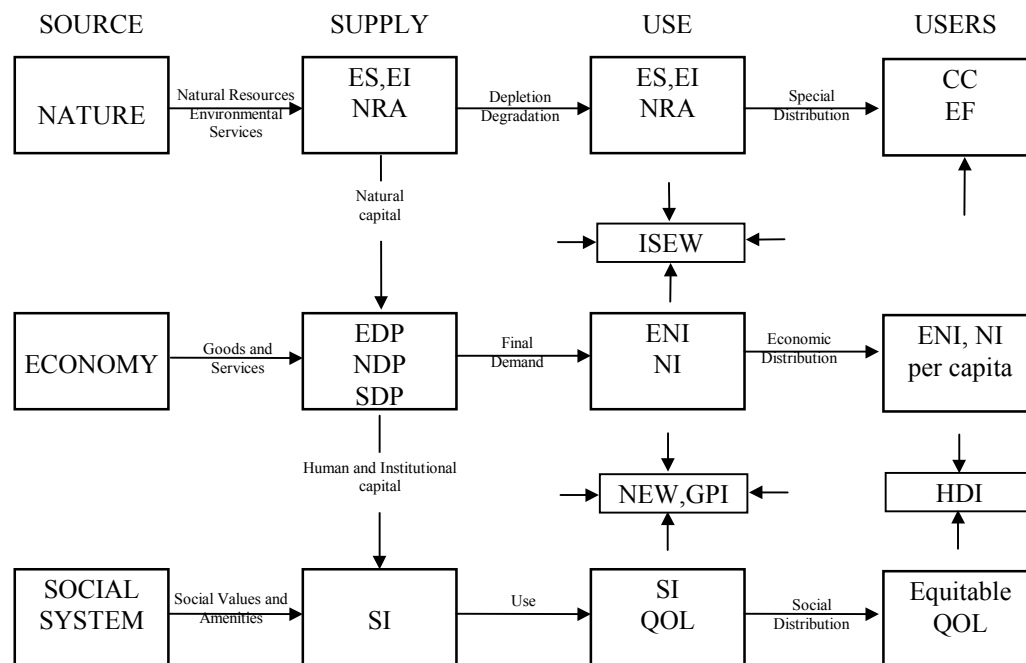
Agenda 21 explicitly urges the creation of a set of parallel accounts to complement the UNSNA. Chapter 40 of Agenda 21, dealing with information needs, endorses the call for suitable indicators of sustainable development in this respect, and calls upon non-governmental organisations to co-operate with UN bodies in developing suitable sets of indicators. The first meeting of the UN Commission on Sustainable Development, which was set up following the 1992 Rio Earth Summit, identified a clear need for a set of standard measures for monitoring progress towards sustainability:

"A measuring stick is required: units by which to distinguish relativity and proximity. This measuring stick should be broad enough to encompass economic, social, environmental, cultural, institutional and other realms of human activity which affect sustainable development. It must also be comprehensive enough to take into account: stresses on economies, ecosystems, and social fabrics; impacts of stresses on the present state of complex systems; and responses to these stresses" (Moldan et al, 1997, p.1).

One of the tangible outcomes of these efforts has been the establishment of a System of Integrated Environmental and Economic Accounting (SEEA). The prime objective of SEEA is provide a framework to mould basic physical statistics and indicators into a physical accounting framework compatible with the financial framework of national accounting (United Nations 1993).

**Figure 3.1** offers a schematic summary of the data bases required for this programme (Bartelmus 1994). The middle row of concepts and measures represents the national accounting framework. The top and bottom rows indicate the additional concepts and measures required to transform the traditional metric of economic growth into a metric of sustainable development.

**Figure 3.1: Sustainability of supply, use and users; concepts and measures (Bartelmus, 1994)**



*Explanations:*

*Acronyms:*

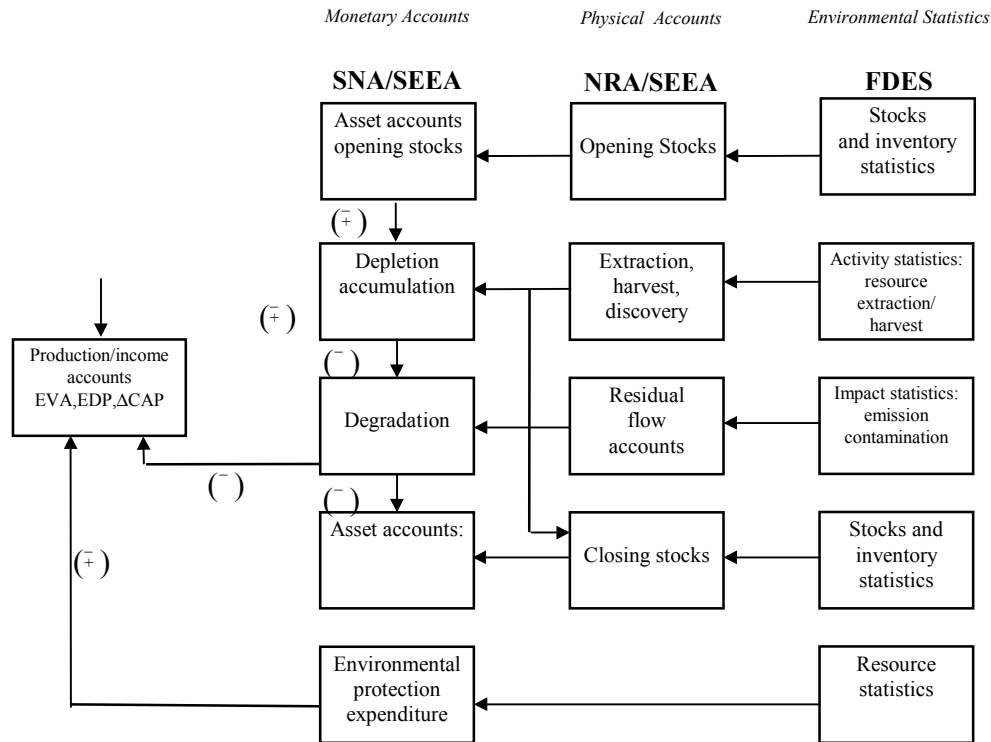
	flows of goods, services and amenities
CC	Carrying Capacity
EDP	Environmentally-adjusted net Domestic Product
EF	Ecological Footprints
ENI	Environmentally-adjusted National Income
EI	Environmental Indicators
ES	Environmental Statistics
GPI	Genuine Progress Indicator
HDI	Human Development Index
ISEW	Index of Sustainable Economic Welfare
NDP	Net Domestic Product
NEW	Net Economic Welfare
NI	National Income
NRA	Natural Resource Accounts (aggregates)
QOL	Quality of Life (indicators)
SDP	Sustainable net Domestic Product
SI	Social Indicators

The additional concepts and measures include both environmental indicators and indicators of the quality of life. Bartelmus, one of the UN representatives on the scientific committee addressing these questions, distinguishes three stages at which sustainable development can be assessed: output (supply), consumption (use), and welfare (users). His schematic diagram is helpful in integrating a wide range of related but distinctive concepts such as ‘ecological footprints’, ‘indices of sustainable economic welfare’, and ‘human development indices’, all of which are attracting considerable research effort. Although these elements are recognised as integral to the evaluation of sustainable development, in practice progress towards a comprehensive set of indicators is in many cases highly constrained by the availability of information and financial resources.

**Figure 3.2** is derived from the concepts and measures used in the previous figure, and illustrates how environmental (but not social) indicators are currently being incorporated into the UNSNA. The right-hand column uses the UN Framework for the Development of Environmental Statistics (FDES) that is based on a variant of the conventional pressure-state-response (P-S-R) model. The FDES column provides a measure of environmental variables. In the middle column is a set of physical accounts

based on research on Material/Energy Balances (MEB) and National Resource Accounts (NRA). These convert the variables provided by FDES into changes in physical states and flows of resources. These physical changes provide the basis for calculating the changes in monetary accounts measured in the left-hand column, applying environmental accounting (SEEA) to the UNSNA.

**Figure 3.2: Incorporating environmental indicators in national accounts**  
(Moldan et al, 1997)



Full integration is only possible by using an appropriate measuring rod to convert physical quantities to monetary values (ie a 'numeraire'). To this end, the SEEA uses various monetary valuations of environmental accounts and the changes within them, recording changes in values as 'costs' to be set against financial measures of income and output. The ultimate outcome is illustrated at the extreme left of the figure, which shows the creation of 'Environmentally-Adjusted Value-Added' (EVA). This allows 'Environmentally-Adjusted Domestic Product' (EDP) and 'Environmentally-Adjusted Capital Accumulation' (dCAP) to be calculated.

Bartelmus observes that:

"these and other (physical and monetary) accounting indicators could play a similar role in the analysis and policies of sustainable growth and development as do standard accounting aggregates in traditional economic analysis and policies" (Moldan et al, 1997, p.117).

**Figure 3.3** summarises the current progress with respect to the UNCSD working list of indicators of sustainable development. This list is also based on the P-S-R model. As commonly applied, this type of model subsumes a notion of causality: a pressure modifies the state of the environment, and this triggers a response from the community. However, the originator of this approach, the OECD, warns against taking this framework to imply a linear relationship between the various levels of interaction that make up sustainable development (OECD 1994). One way of emphasising this point, as **Figure 3.3** demonstrates, is to take the list of factors previously termed 'pressures' when applied to

environmental indicators and rename it 'driving forces' when referring to sustainable development.

**Figure 3.3 CSD working list of indicators of sustainable development (Moldan et al, 1997)**

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
CATEGORY: SOCIAL			
Chapter 3: Combating poverty	- Unemployment rate	- Head count index of poverty - Poverty gap index - Squared poverty gap index - Gini index of income equality - Ratio of average female wage to male wage	
Chapter 5: Demographic dynamics and sustainability	- Population growth rate - Net migration rate - Total fertility rate	- Population density	- GDP spent on education
Chapter 36: Promoting education, public awareness and training	- Rate of change of school-age population - Primary school enrolment ratio (gross and net) - Secondary school enrolment ratio (gross and net) - Adult literacy rate	- Children reaching grade 5 of primary education - School life expectancy - Difference between male and female school enrolment ratios - Women per hundred men in the labour force	- Immunisation against infectious childhood diseases
Chapter 6: Protecting and promoting human health		- Basic sanitation: Per cent of population with adequate excreta disposal facilities - Access to safe drinking water - Life expectancy at birth - Adequate birth weight - Infant mortality rate - Maternal mortality rate - Nutritional status of children	- Contraceptive prevalence - Proportion of potentially hazardous chemicals monitored in food - National health expenditure devoted to local health care - Total national health expenditure related to GNP
Chapter 7: Promoting sustainable human settlement development	- Rate of growth of urban population - Per capita consumption of fossil fuel by motor vehicle transport - Human and economic loss due to natural disasters	- Per cent of population in urban areas - Area and population of urban formal and informal settlements - Floor area per person - House price to income ratio	- Infrastructure expenditure per capita

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
CATEGORY: ECONOMIC			
Chapter 2: International cooperation to accelerate sustainable development in countries and related domestic policies	- GDP per capita - Net investment share in GDP - Sum of exports and imports as per cent of GDP	- Environmentally adjusted Net Domestic Product - Share of manufactured goods in total merchandise exports	
Chapter 4: Changing consumption patterns	- Annual energy consumption - Share of natural resource-intensive industries in manufacturing value-added	- Proven mineral reserves - Proven fossil fuel energy reserves - Lifetime of proven energy reserves - Intensity of material use - Share of manufacturing value-added in GDP - Share of consumption of renewable energy resources	
Chapter 33: Financial resources and mechanisms	- Net resources transfer/GNP - Total ODA given or received as a percentage of GNP	- Debt/GNP - Debt service/export	- Environmental protection expenditures as a per cent of GDP - Amount of new or additional funding for sustainable development
Chapter 34: Transfer of environmentally sound technology, cooperation and capacity-building	- Capital goods import - Foreign direct investments	- State of environmentally sound capital goods imports	- Technical cooperation grants

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
CATEGORY: ENVIRONMENTAL			
Chapter 18: Protection of the quality and supply of freshwater resources	- Annual withdrawals of ground and surface water - Domestic consumption of water per capita	- Groundwater reserves - Concentration of faecal coliform in freshwater - Biochemical oxygen demand in water bodies	- Waste-water treatment coverage - Density of hydrological networks
Chapter 17: Protection of the oceans, all kinds of seas and coastal areas	- Population growth in coastal areas - Discharges of oil into coastal waters - Releases of nitrogen and phosphorus to coastal waters	Maximum sustained yield for fisheries - Algae index	
Chapter 10: Integrated approach to the planning and management of land resources	- Land use change	- Changes in land condition	- Decentralised local-level natural resource management
Chapter 12: Managing fragile ecosystems: combating desertification and drought	- Population living below poverty line in dryland areas	- National monthly rainfall index - Satellite derived vegetation index - Land affected by desertification	
Chapter 13: Managing fragile ecosystems: sustainable mountain development	- Population change in mountain areas	- Sustainable use of natural resources in mountain areas - Welfare of mountain populations	
Chapter 14: Promoting sustainable agriculture and rural development	- Use of agricultural pesticides - Use of fertilizers - Irrigation per cent of arable land - Energy use in agriculture	- Arable land per capita - Area affected by salinization and waterlogging	- Agricultural education

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
CATEGORY: ENVIRONMENTAL			
Chapter 11: Combating deforestation	- Wood harvesting intensity	- Forest area change	- Managed forest area ratio - Protected forest area as a percent of total forest area
Chapter 15: Conservation of biological diversity		- Threatened species as a per cent of total native species	- Protected area as a percent of total area
Chapter 16: Environmentally sound management of biotechnology			- R & D expenditure for biotechnology - Existence of national biosafety regulations or guidelines
Chapter 9: Protection of the atmosphere	- Emissions of greenhouse gases - Emissions of sulphure oxides - Emissions of nitrogen oxides - Consumption of ozone depleting substances	- Ambient concentrations of pollutants in urban areas	- Expenditure on air pollution abatement
Chapter 21: Environmentally sound management of solid waste and sewage-related issues	- Generation of industrial and municipal solid waste - Household waste disposal per capita		- Expenditure on waste management - Waste recycling and reuse - Municipal waste disposal
Chapter 19: Environmentally sound management of toxic chemicals		- Chemically induced acute poisonings	- Number of chemicals banned or severely restricted
Chapter 20: Environmentally sound management of hazardous wastes	- Generation of hazardous wastes - Imports and exports of hazardous wastes	- Area of land contaminated by hazardous wastes	- Expenditure on hazardous waste treatment
Chapter 22: Safe and environmentally sound management of radioactive wastes	- Generation of radioactive wastes		

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
CATEGORY: INSTITUTIONAL			
Chapter 8: Integrating environment and development in decision making			- Sustainable development strategies - Programme of integrated environmental and economic accounting - Mandated Environmental Impact Assessment - National councils for sustainable development
Chapter 35: Science for sustainable development		- Potential scientists and engineers per million population	- Scientists and engineers engaged in R & D per million population - Expenditure on R & D as a per cent of GDP
Chapter 37: National mechanisms and international cooperation for capacity-building in developing countries			
Chapter 38: International institutional arrangements			
Chapter 39: International legal instruments and mechanisms			- Ratification of global agreements - Implementation of ratified global agreements
Chapter 40: Information for decision-making		- Main telephone lines per 100 inhabitants - Access to information	- Programmes for national environmental statistics
Chapter 23-32: Strengthening the role of major groups			- Representatives of major groups in national councils for sustainable development - Representatives of ethnic minorities and indigenous people in national councils for sustainable development - Contribution of NGOs to sustainable development

'Driving force' indicators represent human activities that have an impact on sustainable development. They are used to provide some indication of the cause of a positive or negative change in a state of development. The UNCSO indicators are primarily national in scope, although encouragement is given for the development of lower tier indicators. The essential distinction between the original P-S-R model and this derivation is that by replacing pressures with driving forces the adapted model attempts to accommodate activities which can work in either a beneficial or a harmful direction with respect to sustainability. Nevertheless, in terms of their effectiveness as performance indicators, the lack of direct causality, although perfectly valid, creates problems in interpreting the results:

"the indicators are not necessarily linked horizontally in the DSR framework. However, this does not imply that a causal link does not exist among some of the driving force, state and response indicators. This link may well exist for indicators for some aspects of sustainable development and for some chapters of Agenda 21. Vertically, a causal relationship may exist for a few indicators if, for example, a driving force for one chapter of Agenda 21 impacts causally on a driving force indicator for another chapter" (Mortensen 1997, p.51).

### *OECD Initiatives*

The OECD initiated a specific programme on environmental indicators in 1990, following a request at the 1989 Group of Seven summit. The following criteria were agreed (Lister 1997):

- agreement on terminology and a conceptual framework common to OECD countries (eg PSR models, core issues of concern);
- identification and definition of indicators on the basis of three major criteria: policy relevance, analytical soundness, and measurability;

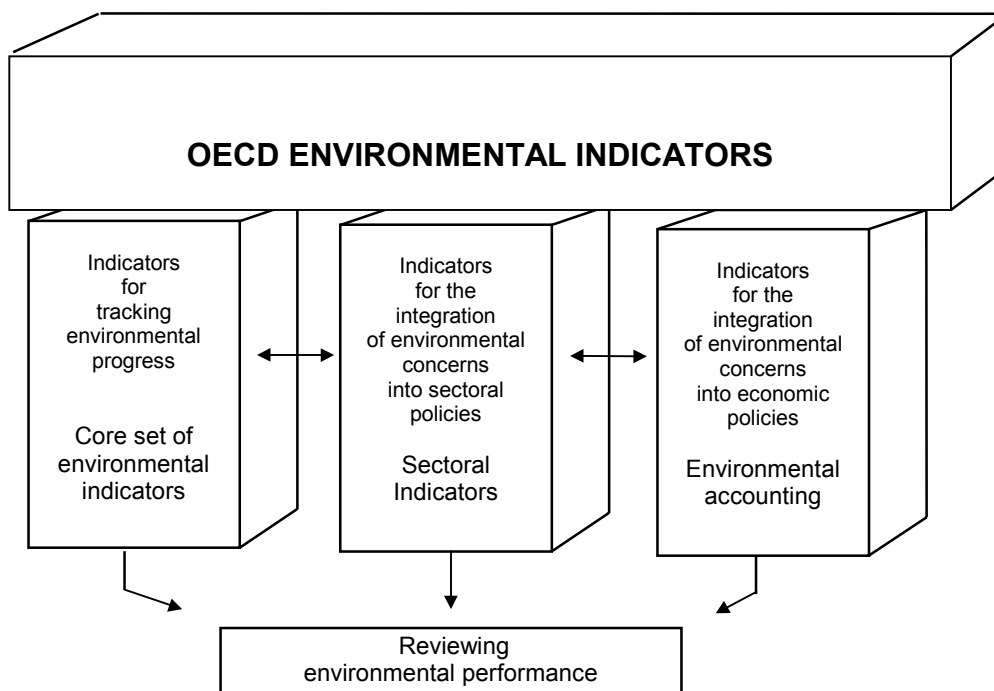
- measurement of these indicators for a number of countries;
- regular use of these indicators in the OECD's analytical work and environmental performance reviews.

The OECD's work aims at developing environmental indicators for three major purposes:

- tracking environmental progress (monitoring the environment and changes over time);
- better integration of environmental concerns into sectoral policies;
- better integration of environmental concerns into economic policies.

The OECD indicators therefore provide a tool for measuring environmental performance rather than for implementing sustainable development, although they provide an essential baseline for monitoring the environmental aspects of sustainability. **Figure 3.4** provides a schematic illustration of the way in which the OECD environmental indicators operate. A core set of environmental indicators monitoring environmental progress, based on a P-S-R model, is linked with indicators for assessing the integration of environmental concerns with economic policies (represented by environmental accounting) and into sectoral policies (represented by sectoral indicators).

**Figure 3.4: OECD environmental indicators** (Linster, 1997)



The outcomes are published in OECD reviews of the relative environmental performance of member states. An example of the way in which the OECD approach can be used to map out the integration of environmental concerns into specific sectoral policies is illustrated in **Table 3.1**. This uses the example of transport policies. Three levels of integration are identified:

- actions concerning traffic management;
- actions concerning transport infrastructures;
- actions concerning vehicles and motor vehicle fuels.

The appropriate sectoral indicators are identified in the left-hand column and associated with the environmental indicators in the central column and the economic indicators in the right-hand column. Taken together, the overall set of indicators offers a useful way of monitoring progress towards two of the strands of sustainable development within the transport sector, although it neglects social impacts (which in this sector can be of major significance).

**Table 3.1: OECD indicators for the integration of environmental concerns into transport policies** (Linster 1997)

SECTORAL TRENDS OF ENVIRONMENTAL SIGNIFICANCE	ENVIRONMENTAL INTERACTIONS	ECONOMIC CONSIDERATIONS
<p>1 <b>Overall Traffic Growth and Modal Split</b> *Passenger traffic trends by mode (private cars, buses and coaches, railways, air) in passengers x km * Freight traffic trends by mode *Road traffic trends in vehicles x km *Trends of airport traffic: number of movements *Trends in tonnage handling in national harbours.</p> <p><b>Infrastructure</b></p> <p>2 *Capital expenditure: total and by mode</p> <p><b>Vehicles and Mobile Equipment</b></p> <p>3 *Number of road vehicles, (automobiles, commercial vehicles): total, gasoline, diesel, others</p>	<p>1 <b>Resource Use</b> *Total final energy consumption of the transport sector (share in total, per capita, by mode), in tonnes of oil equivalent</p> <p>2 <b>Air Pollution</b> *Transport emissions - CO<sub>2</sub>, NO<sub>x</sub>, VOC, CO, etc. (share in total, per capita, by mode) *Emissions per vehicle km - CO<sub>2</sub>, NO<sub>x</sub>, VOC, CO, etc</p> <p>3 <b>Water Pollution</b> *Tonnage of oil released through accidents and discharges during current operations</p> <p>4 <b>Noise</b> *Population exposed to noise greater than 65 dB(A) from transport</p> <p>5 <b>Waste</b> *Tonnage of transport-related waste *Tonnage of hazardous waste, imported or exported</p> <p>6 <b>Risk and Safety</b> *Number of people killed or injured *Tonne km of hazardous materials transported</p>	<p>1 <b>Environmental Damage</b> *Environmental pollution damage relating to transport</p> <p>2 <b>Environmental Expenditure</b> *Total expenditures on pollution prevention and/or clean-up *R&amp;D expenditure on quiet, clean, energy-efficient vehicles *R&amp;D expenditure on clean transport fuels</p> <p>3 <b>Taxation and Subsidies</b> *Direct subsidies *Direct and indirect subsidies *Total economic subsidies (direct and indirect subsidies, plus externalities) *Relative taxation of vehicles and vehicle use</p> <p>4 <b>Price Structure</b> *Trends in gasoline (leaded, unleaded), diesel and other fuel prices and public transport prices in real terms</p> <p>5 <b>Trade and Environment</b> *Indicator to be developed</p>

### *European Union Initiatives*

Much of the work undertaken at EU level parallels UN and OECD initiatives. Currently there is no EU Standard working definition either of sustainable development or indicators to this end. Most work noted below adopts OECD/UN approaches. The most commonly accepted definition is that embodied in Local Agenda 21 initiatives, which employs the UNEP definition: improving the quality of life within the carrying capacity of supporting ecosystems. Section 3.3 below examines the indicators associated with LA21 initiatives.

The European Commission programme consists of three distinct areas:

- the Environmental Pressure Indices (EPI) programme;
- a pilot publication of EU indicators based on the UNCSD list (see **Figure 3.3** above);

- a number of projects within the EU general research programme.

The programme is being co-ordinated by Eurostat (Eurostat 1997). It is tailored to the monitoring of ten policy areas (or ‘policy fields’) of the Fifth Environmental Action Programme (CEC 1993):

- climate change
- ozone layer depletion
- loss of biodiversity
- resource depletion
- waste
- air pollution
- dispersion of toxins
- water pollution and water resources
- marine environment and coastal zones
- urban problems, noise and odours.

The EU Scientific Advisers Group is responsible for identifying appropriate indicators in these fields. Parallel with these policy fields are sectoral infrastructure projects (SIPs) that are aimed at identifying the indicators within a sectoral context. These are focused on the six target sectors of the Fifth EAP:

- energy
- agriculture
- transport
- industry
- tourism
- waste management.

Each of the six SIPs has two elements: an indicators element which aims to identify pressure indicators by sector and to develop the methodologies needed to calculate these; and a basic data element which aims to evaluate the steps needed to provide the statistical inputs required to calculate these indicators.

The third element of the programme is a set of eight ‘Environmental Pressure Information System’ projects. These are aimed at supplying indicators through a database designed to integrate physical and economic data along the lines illustrated by the OECD work demonstrated in **Table 3.1**.

The 1997 publication of Eurostat indicators of sustainable development (Eurostat 1997) includes a substantial section on what it terms ‘social indicators’. This covers indicators of population growth and density, migration, fertility, infant mortality, life expectancy, health expenditure, unemployment and participation rates, male/female wage ratios, urbanisation, floor area per person and per capita consumption of fossil fuel for motor vehicle transport.

These indicators do not offer any guidance on social cohesiveness and participation in decision-making processes, which as discussed in the previous chapter are central to LA21. The explanation for this omission is to be found in the type of model used by Eurostat (and by the UK), which is driven by the OECD P-S-R approach. This focuses on the use of indicators of pressure, such as population growth, on the state of the environment.

### 3.3 National Applications

#### *Indicators of sustainable development*

The UK initiatives on indicators of sustainable development have grown out of the country's commitment made at the 1992 Rio Earth Summit. Following the publication in 1994 of the UK strategy for Sustainable Development, an inter-departmental Indicators Working Group was created which in 1996 published its initial report (DoE 1996). The chosen indicators were designed to enable the aspirations for sustainable development to be translated into four quantifiable aims (Morrey 1997):

- a healthy economy should be maintained to promote quality of life, while at the same time protecting human health and the environment;
- non-renewable resources should be used optimally;
- renewable resources should be used sustainably;
- damage to the carrying capacity of the environment and risk to human health and biodiversity should be minimised.

Given the need to determine the long term direction along which the UK economy was moving, efforts were focused on establishing trends rather than determining absolute levels. The trends indicators have been tied into targets or guidelines where these exist. Over three hundred indicators were initially developed. To reduce these to manageable proportions, a systematic approach was applied. Key issues and objectives within the UK strategy were used to focus the indicators down into twenty-one 'families', which cover the following aspects of sustainable development:

- the economy
- transport use
- leisure and tourism
- overseas trade
- energy use
- land use
- forestry
- fish and water resources
- climate change
- ozone layer depletion
- air, water and soil quality
- landscape
- wildlife and habitats
- waste
- minerals extraction
- radioactivity.

The 1996 report sets out the chosen indicators under the above headings. For each family of issues, objectives have been identified to make the development process more sustainable. Indicators were selected to monitor the achievement in attaining these objectives, applying a variant of the standard P-S-R model. This involved extending coverage into states of the economy (ie levels of unemployment and rates of inflation) as well as the environment. In addition, efforts were made to relate pressures on the environment and the economy to the benefit or welfare generated by the activity. This allowed the pressure indicators to be used to determine the relationship between the environment and socio-economic development, a relationship which is central to the attainment of sustainability.

For waste, for example, the UK report identifies a total of seven indicators:

- four ‘pressure’ indicators
  - household waste
  - industrial and commercial waste
  - special waste
  - waste going to landfill

and

- three ‘response’ indicators
  - household waste recycling and composting
  - materials recycling
  - energy from waste.

Given the topic, there are no ‘state’ indicators. Links are identified with industry, health, energy and households. The indicators chosen can be readily monitored and have relevance in developing the National Waste Strategy as part of the overall UK strategy for sustainable development.

More recently, the DETR has followed up this basic work by publishing a consultation paper (DETR 1998a) offering a set of ‘headline’ indicators, as part of its preparations for a revision of the overall UK strategy. The headline indicators increase the emphasis on social indicators such as measures of social inclusion. **Table 3.2** sets out the indicators suggested to provide a broad brush picture of progress towards sustainability. This initiative has attracted criticism from a number of sources on the grounds that it unduly simplifies the relationships within which relevant policies have to be framed, undermining the link that should exist between the choice of indicators and their use as a measure of operational performance (eg Ghazi 1998, Levett 1999).

**Table 3.2: Proposed UK headline indicators of sustainable development (DETR 1998a)**

<b>Maintenance of high and stable levels of economic growth and employment</b> – <i>so that everyone can share in high living standards and greater job opportunities, and to generate the income and wealth needed to pay for essential infrastructure and future investment.</i>	
<b>Economic growth</b>	Total output of the economy (gross domestic product)
<b>Social Investment</b>	Investment in public assets (transport, hospitals, schools, etc)
<b>Employment</b>	People of working age who are in work
<b>Social progress which recognises the needs of everyone</b> – <i>ensuring that better health, a good education and decent housing, are available to everyone in our society, no matter who they are and where they live.</i>	
<b>Health</b>	Expected years of healthy life
<b>Education and training</b>	Qualifications at age 19
<b>Housing quality</b>	Homes judged unfit to live in
<b>Effective protection of the environment</b> – <i>limiting the emissions of greenhouse gases which are causing the global climate to change, ensuring that people’s health does not suffer from poor air quality or other pollution, and protecting wildlife and the countryside.</i>	
<b>Climate change</b>	Emissions of greenhouse gases
<b>Air pollution</b>	Days of air pollution
<b>Transport</b>	Road traffic
<b>Water quality</b>	Rivers of good or fail quality
<b>Wildlife</b>	Population of wild birds
<b>Land use</b>	New homes build on previously developed land
<b>Prudent use of natural resources</b> – <i>ensuring that we use resources efficiently and minimum waste.</i>	
<b>Waste</b>	Waste and waste disposal

During 1999, the DETR followed up this initiative by producing a new strategy for sustainable development (DETR, 1999a) and a set of indicator factors (DETR, 199b). The latter publication offers a baseline assessment of the indicators to enable progress to be monitored. Greater emphasis has been placed on measures of social inclusion, but many of the remaining indicators are retained from the 1996 work (DOE, 1996). The Scottish Executive is commissioning complementary studies in this area.

Although a number of other member nations of the OECD are planning to emulate the UK and publish headline indicators, examples can also be found of developments in the opposite direction, towards creation of detailed *social accounting matrices* (SAMs). These use Leontieff input-output frameworks and are usually based on standard input-output tables. They are capable of plotting the environmental and social consequences of economic action, and the economic and social consequences of environmental action.

A promising example of SAMs has been pioneered by the Scottish Office (Alexander & McNicoll 1995). A more comprehensive version has been developed for the Californian economy. Golan et al (1999) illustrate how this can be applied to plot the impact of the cultivation of cotton on the Californian economy and environment. The attraction of these models is that they enable the impact of policy initiatives to be tested and traced fully through the system. **Table 3.3** reproduces the SAM calculation of the damage offsite created by soil erosion arising from cotton cultivation in California. By manipulating the SAM it is possible to identify the most cost-effective policy responses both in aggregate and in terms of the distribution of social impacts.

**Table 3.3: Off-site damage from California cotton soil erosion by type of damage - 1982** (Golan et al, 1999)

Activity	Erosion damage	
	Total	Percentage
Freshwater recreation	392,400	27.0
Marine recreation	110,500	7.6
Commercial freshwater fishing	11,200	0.8
Commercial marine fishing	71,200	4.9
Water storage	263,500	18.1
Navigation	138,100	9.5
Flooding	180,200	12.4
Drainage ditches	49,400	3.4
Irrigation ditches	21,800	1.5
Irrigated agriculture (salinity)	5,800	0.4
Municipal water treatment	24,700	1.7
Municipal and industrial users	174,400	12.0
Steam electric power plants	10,200	0.7
<b>Total</b>	<b>1,453,400</b>	<b>100.0</b>

### *The Index of Sustainable Economic Welfare*

A number of attempts have been made by economists to adapt current national accounts to provide a more accurate measure of changes in welfare over time. Almost three decades ago, two leading US economists demonstrated that when proper account is taken of factors which are not adequately measured by GDP, living standards could be shown to have grown by far less in the postwar period (Nordhaus & Tobin 1972). Based on the same principles, researchers in the USA and UK have adapted national accounts to provide an Index of Sustainable Development (ISEW).

The index is designed to include both benefits and costs of resource use which are not incorporated into the standard system of national accounts.

The US ISEW now forms the basis for what is termed "the Genuine Progress Indicator" (Cobb & Cobb 1994). A pilot UK ISEW for the period 1950-1990 has been published (Jackson & Marks 1994), which has been updated and extended to 1996 (Jackson et al 1997, Mayo et al 1997). Work undertaken at the University of Stirling on behalf of the Scottish Office has adapted Scottish estimates of GDP on the same basis (Moffat et al 1994, Moffat and Wilson 1994).

The following major adjustments to standard national accounts are made to calculate an ISEW:

- spending to offset social and environmental costs (defensive expenditure) is netted out;
- longer term environmental damage and depletion of natural capital are taken into account;
- only net reproducible capital formation (net investment) is included;
- adjustments are made to take account of changes in the distribution of income;
- an estimate of the value of household labour is included.

In adapting current national accounts to incorporate better allowances for social and environmental factors, the ISEW represents an advance over the more rough and ready calculation of "real" savings ratios considered in Section 2 above. Nevertheless, the findings are similar. Apparent rises in living standards measured by conventional means are transformed into much smaller and less positive trends. For the UK, for example, real GDP per head increases by 2.5 times between 1950 and 1996, giving an average annual increase of 2%. Applying ISEW adjustments, the trend is far more modest and includes periods of negative movement. Overall, the level of ISEW in 1996 was only 31% higher than in 1950, which represents an annual average rate of growth of just 0.6%.

One of the major factors in the increasing divergence between GDP and ISEW measures in the UK in recent decades can be found in their divergent treatment of the depletion of non-renewable hydrocarbon reserves (essentially North Sea oil and gas). A further factor is the inclusion by the ISEW of an allowance for the accumulating costs of global warming. Such adjustments are at the heart of any index of sustainability. The UK ISEW, for example, makes an estimate of cumulative environmental damage and calculates and deducts the present value of future welfare losses associated with this. Other important considerations are the welfare costs associated with growing income inequality. Deductions in this respect are based on an estimate of social aversion to such inequality. Because of these factors, the index for Scotland for the period 1980-91 shows a downward trend for ISEW in contrast to a clear upward trend for GDP. Calculations for Scotland are particularly sensitive to:

"distributional inequality, services from household labour, depletion of non-renewable resources and long-term environmental damage" (Moffat & Wilson 1994, p.289).

Neumayer (1999) presents a powerful critique of the ISEW approach, arguing that it lacks a sound theoretical foundation, and that its results depend on a few arbitrary assumptions (eg certain applications of this approach discount technical progress and suggest that educational expenditures should not count as investment in human capital and that they may even be regarded as defensive expenditure which should not be included when calculating consumption levels). Sensitivity analysis applied by Neumayer to key variables throws into question the central finding of these studies, that ISEW has been declining in the most recent periods in many high-income industrialised market economies.

While there are a large number of other national initiatives (the example of the NEPP in the Netherlands was discussed in the previous chapter), examples of the use of indicators to evaluate performance in the delivery of programmes are more likely to be found at sub-national levels. These are considered in the remaining parts of this chapter.

### 3.4 Regional and Local Government Initiatives

#### *LA21*

Many sub-national bodies have developed their own indicators of sustainable development, in response to Local Agenda 21, and in recognition of the need to create community involvement in the promotion of sustainability. As Morrey (1997) observes, whatever the merits of such initiatives in selling the concept, one of the problems with regional and local indicators, whether originating from governmental, non-governmental or community bodies, is that they tend to promote a proliferation of approaches which make aggregation and policy assessment at a higher level difficult:

"These indicators may be highly relevant to local people, but they cannot be aggregated to give a regional or national picture. Moreover, it is not clear how such indicators relate to national or regional norms or how they can be used to compare the achievements of one area with another which has similar characteristics. Many authorities are understandably wary of the development of further sets of performance indicators" (p.325).

Nevertheless, the Local Government Management Board (LGMB) in the UK has taken a number of initiatives to promote best practice in this respect (eg Touche Ross 1994 & 1995, CAG Consultants 1998). The LGMB has identified six essential elements for implementing LA 21:

- managing and improving the local authority's own environmental performance;
- integrating sustainable development aims in the local authority's policies and activities;
- raising awareness of and promoting education about sustainable development;
- consulting and involving the public;
- creating partnerships;
- measuring, monitoring and reporting on progress towards sustainability.

The management aspects of this agenda are catered for by the development of the Local Authority Eco-Management and Audit Scheme (LAEMAS), which has been derived from the site-specific EU EMAS Directive, and extended to cover policy and service effects as well as direct impacts. Monitoring the effectiveness of a local authority's policies, programmes and projects in promoting a more sustainable development pathway requires the use of indicators. **Table 3.4** lists the themes agreed in the LGMB pilot study on indicators. These link the economy, quality of life and the environment through the UNEP definition of sustainable development: improving the quality of life within the carrying capacity of supporting ecosystems. Thus the first three themes deal with carrying capacity, while quality of life is taken to mean meeting local needs for basic necessities, health, access to facilities, work, freedom from crime and persecution, involvement in the community, etc.

**Table 3.4: Requirements for a sustainable community: themes for Sustainability Indicators Research Project (Touche Ross, 1994)**

Theme	Meaning
<b>Resources and waste</b>	Efficient use of resources and waste minimisation by closing cycles.
<b>Pollution</b>	Limitation of pollution to levels within the carrying capacity of natural systems.
<b>Biodiversity</b>	Valuing and protecting the diversity of nature.
<b>Localness</b>	Meeting needs locally where possible
<b>Access to basic needs</b>	Offering everyone access to good food, water, shelter and fuel at reasonable cost.
<b>Work</b>	Providing everyone the opportunity to undertake satisfying work in a diverse economy; recognising the value of unpaid work; offering fair and fairly distributed payments for work.
<b>Health</b>	Protecting people's good health by creating safe, clean, pleasant environments and health services which emphasise prevention as well as proper care for the sick.
<b>Access to facilities</b>	Ensuring access to facilities, services, goods and other people is not achieved at the expense of the environment or limited to those with cars.
<b>Crime</b>	Offering people opportunity to live without fear of personal violence from crime or persecution because of their personal beliefs, race, gender or sexuality.
<b>Access to skills and knowledge</b>	Access to skills, knowledge and information to enable everyone to play a full part in society.
<b>Empowerment</b>	Empowering all sections of the community to participate in decision-making.
<b>Culture and recreation</b>	Making opportunities for culture, leisure and recreation readily available to all.
<b>Aesthetics</b>	Combining meaning and beauty with utility in places, spaces and objects; providing settlements human in scale and form; valuing and protecting diversity and local distinctiveness.

The piloting authorities, including one in Scotland (Fife) were given the task of developing and testing indicators derived from these themes, and of looking for meaningful measures which were both practicable and acceptable locally. In some cases, there was a clear trade-off between public acceptance and scientific rigour. Of the 101 possible indicators suggested by the consultants, 95 were chosen by the piloting authorities, but only seven were chosen by seven or more of the ten authorities involved. Many were adapted, and 45 additional ones were developed. **Table 3.5** lists the trend indicators selected by Fife.

**Table 3.5: Summary of Trends in chosen Fife Sustainability Indicators (Economic Planning and Development Department, 1995)**

Away from sustainability	No clear trend	Towards sustainability
Homelessness	Affordable warmth	Life expectancy
Long term unemployment	Alternative means of transport	Infant mortality
Poverty	Crime	Nursery education
Land quality	Air quality	Pedestrian and pedal cyclist safety
Biodiversity	Household waste	
Quality of surface and underground water	Sewage treatment and disposal	
Pleasant urban environment		
Food supply: agriculture		
Food supply: fisheries		
Energy		

A number of UK local authorities selected to shadow the piloting authorities produced their own sets of indicators, including two regions in Scotland: Central and Strathclyde (Development and Planning Services 1996, Strathclyde Regional Council 1995). More recently, local authorities which have adopted a clear strategic stance towards sustainable development have sought to bind indicators into their corporate management structure, and to identify effective linkages between these and council

programmes, using datasets available at local level (eg Bell et al 1997, Fife Council 1997, Lancashire County Planning Department 1997).

### *The Use of Indicators in an Urban Context*

Leicester's approach (Bell et al 1997) offers an insight into current best practice in this respect. In 1996, the authority's Environment and Development Department undertook a sustainability appraisal of its own development plan, applying DoE environmental appraisal guidance. Linked with this, a local consultancy was employed to illustrate how the authority could develop suitable local indicators of sustainable development to help quantify the appraisal process, rather than simply flag up areas of concern.

The key features in the City of Leicester appraisal process are:

- an explicit and systematic environmental review of the development plan, its policies and programmes, undertaken to evaluate both the individual and the combined impact of these proposals on local sustainability;
- incorporation of the appraisal as an integral part of the process of drafting the development plan, and of considering actual alternatives during the preparation process, so that the appraisal is not simply a one-off exercise stuck on at the end when the desired outcomes have already been determined on other grounds;
- basing the appraisal on a quantifiable baseline of environmental quality using indicators wherever possible.

Despite these intentions, even the 'European Sustainable City of 1996' did not have in place at the time of the initial exercise sufficient data and capacity to incorporate sustainability indicators as such within the environmental appraisal of the development plan. Instead, for the time being, Leicester decided to apply the simple DoE flagging matrix. Nevertheless, there have been important gains. Once the overall policy aspect has been subject to this treatment, then any part of it which has attracted flagging that suggests it might be working against sustainable development is given a more detailed application of the same matrix, applied this time to the individual parts of the programme identified as needing further investigation. This allows the identification of components which contribute to the adverse impact, at which stage these can be re-examined. The exercise is said to be relatively simple and straightforward, while allowing rapid identification of areas of council policy that require attention. The eventual use of indicators will allow quantification of these areas of concern.

### *Indicators of Rural Disadvantage*

Attention has rightly been focused on identifying concentrations of urban deprivation, using indicators which have identified Glasgow and urban Clydeside as containing some of the largest concentrations of multiple deprivation in the European Union. However, a significant proportion of Scotland's population lives in rural or semi-rural districts (between 11% and 15% according to definition). A number of studies have attempted to develop indicators capable of measuring rural deprivation or disadvantage, beginning with work funded by the Scottish Office some two decades ago (Burbridge & Robertson 1978). The concept of rural disadvantage is more nebulous than its urban counterpart (Midwinter & Monaghan 1990), and several recent studies have sought to complement the area-based approach, which relies upon small area data from the decennial Population Census to provide the

foundations of urban poverty analysis, with client-based rural surveys (eg Shucksmith et al 1994, Shucksmith et al 1996).

The area-based information available on rural disadvantage is limited. Studies indicate that around a quarter of rural households are living in or on the margins of poverty in Scotland (ie with incomes up to 139% of their supplementary benefit entitlement). This increases to a third of rural households containing single elderly people (Shucksmith et al 1996, p.9). There is in addition a much greater polarisation of incomes in rural areas:

"The full extent of the rural poor's marginalisation is underlined by the patterns of inequality in the distribution of household income. In contrast with the national pattern... in which 11% of household heads had gross disposable incomes of at least three times the SB eligibility level, the corresponding rural aggregate was 26%" (McLaughlin 1986, p.89).

Rural disadvantage is also correlated with variables which differ from those in urban areas. Far fewer of the rural poor live in overcrowded conditions or in public sector housing, far more are identified with low socio-economic status and pensionable age. The standard Scottish Office approach to identify multiple deprivation has tended to favour urban problems. Miller (1980) used the following indicators, based on small area Population Census data:

- overcrowding
- head of household unemployed
- low SEG of household
- lack of basic amenities
- single-parent families
- pensioner households
- large families
- households with no car
- head of household with no educational qualifications
- households with three rooms or fewer.

The first and last of these indicators are peculiar to urban conditions. The use of car-less households as an indicator gives a peculiar bias against rural deprivation. Scottish Office studies confirm that car ownership in rural areas is more closely correlated with inaccessibility than with income. The need for a vehicle to live in remote rural areas suggests that disadvantaged households may enjoy even less disposable income in a rural context:

"the outlay on purchase, maintenance and running costs of a car, where low income households are concerned, may well prejudice quite severely other aspects of the quality of life....

"[Because of the] high marginal utility of vehicle ownership in a remote area there may be considerable difficulty in interpreting car ownership statistics... a car in a remote area may be both highly unreliable and barely affordable but nevertheless essential to survival, and any households without a car in remote areas, with dispersed settlement patterns, must be at a severe disadvantage" (McCleery et al 1987, p.14).

**Table 3.6** summarises one aspect of the results of an extensive survey of town centre users in Angus burghs undertaken in the summer of 1998, which indicates the degree to which cars provide the predominant means of access to town centres even in non-remote rural areas. For those who are

resident outside the burghs, car transport predominates and public transport is very much an ancillary mode. Even for residents of what are small burghs, car transport remains very important as a mode of access.

**Table 3.6 CCTV survey of Town Centre users in Angus Burghs, Summer 1998 (722 respondents)**

Place of residence	% town centre respondents by main mode of transport		
	Car	Foot	Public transport
This burgh	34	55	7
Local area outside burgh	81	5	14
Elsewhere in Angus/Dundee	83	6	10
Outside Angus Dundee in Scotland	66	27	5
Other	65	9	-
<b>All</b>	<b>48</b>	<b>41</b>	<b>8</b>

Recent work on indicators of rural disadvantage has come to see social isolation as an important measure of poverty. Work undertaken for Rural Forum and the Scottish Consumer Council (Shucksmith et al, 1996) has combined client-based survey work with area-based small area data, applying the following indicators:

- old age (especially for low SEGs)
- low wages
- unemployment
- low economic activity rates among married women
- poor housing conditions
- social isolation.

Since one of the areas chosen for survey work is a rural part of Angus, this has particular relevance for Tayside. The most interesting finding of this study is that the subjective assessments of rural poverty or disadvantage made by rural residents are at odds with "objective" economic indicators:

"Poverty by objective criteria is widespread in rural Scotland, with 65% of heads of households receiving incomes below the Low Pay Unit Poverty threshold.... Moreover, 49% of the sample had incomes below half the median Scottish wage... Yet many households experiencing poverty by these definitions would reject such an assessment of their position... people generally feel there is little poverty or disadvantage in their rural communities. Partly this divergence between objective and subjective perceptions arises from the stigmatic associations of terms such as poverty and disadvantage; partly it arises from contradictions with the dominant representation of the countryside; and partly it arises from many residents feeling that the non-monetary benefits of rural life outweighed the material disadvantages... The other major explanation is that relative poverty was conceived of as a comparison with lifestyles of the past, when conditions were much harsher, rather than with the current lifestyles of the majority" (Shucksmith et al 1996, p.509).

Another significant finding is that:

"The majority of respondents (72%) saw room for improvement in service provision, and transport emerged as the main area of concern. The crucial transport disadvantage is not access to public transport but rather the cost of having to have private transport in such a car-dependent context. Transport is essential for accessing services, visiting family and friends, and for access to work. The overwhelming majority could see no realistic future for rural transport other than universal car ownership, with rural subsidies..." (ibid., p.513).

One conclusion to be drawn from the findings of such research is that an approach to the problem of rural disadvantage which is based on the creation of sustainable rural communities is preferable to attempts to use traditional policies to encourage eligible individuals to take-up benefits, when many do not regard themselves as disadvantaged. Repair grants to improve rural housing stock, along with community-based rural initiatives to improve rural accessibility and rural job opportunities, especially for females, offer what may be a more effective strategy to one which relies on promoting individual claimant benefit take-up. Suitable indicators for rural sustainability would include factors such as the extent to which local jobs are being created/lost, local housing stock is occupied/unoccupied and in good repair/disrepair, local schools remain open/are closed, local shops, post offices and recreational/leisure facilities are available/not available, and community-based transport (such as postbuses and shared school transport) is provided/not provided.

### **3.5 Community Initiatives**

Agenda 21 emphasises the need for community involvement in promoting sustainable development (Selman 1996). Despite Morrey's reservations when the wider picture is considered, there have been a large number of community-based initiatives on top of regional and local government work, which have sought to identify indicators of sustainable development suitable for a range of communities, ranging from metropolitan to rural in scale (eg Atkinson 1995, Association of London Government 1997, Dundee Sustainability Forum 1997, Hamilton-Wentworth 1993, Walter & Wilkieston 1998). Within the UK these initiatives share a certain degree of commonality in their interpretation of sustainable development, which finds its origins in the national strategy. Overall, however, the most characteristic element of these approaches is their lack of uniformity.

#### *Sustainable Seattle*

Undoubtedly the best known of the community-based initiatives (which also entailed a high degree of municipal involvement) is that undertaken by Seattle. However, as a perceptive commentator has observed (Brugmann 1997), the value of indicators of sustainable development such as those developed by Seattle may be attenuated through their use to meet several multiple and sometimes vague or contradictory community objectives. In Brugmann's opinion, Seattle illustrates:

"how a set of well-developed indicators can fail to meet their objectives if they are unrelated to a methodical planning process" (p.59).

Alternative examples of community-based municipal initiatives in North American are used by Brugmann to illustrate how better design can achieve more effective results. Brugmann concludes that:

"at the local level, indicators are ideally suited for performance measurement. Indicators are a sub-optimal tool for technical assessment and even public education. Applications of

indicators for these two purposes can compromise the performance measurement function" (p.59).

The basis of Brugmann's critique, which has important implications for the use of indicators by local and regional development agencies, is the complexity revealed by other research into the scope and purpose of indicators of sustainable development (Maclaren 1996). Maclaren's work identifies five different sets of indicators (with one divided into alternatives). Each of these sets could be useful in evaluating different aspects of sustainability within a community, but for each there would be separate methodological complexities, data requirements and standards of application:

- *integrating indicators* or *indexes* to portray linkages between economic, social and environmental phenomena;
- *trend indicators*, linked to targets or thresholds;

either

- *predictive indicators*, relying upon mathematical forecasting models;

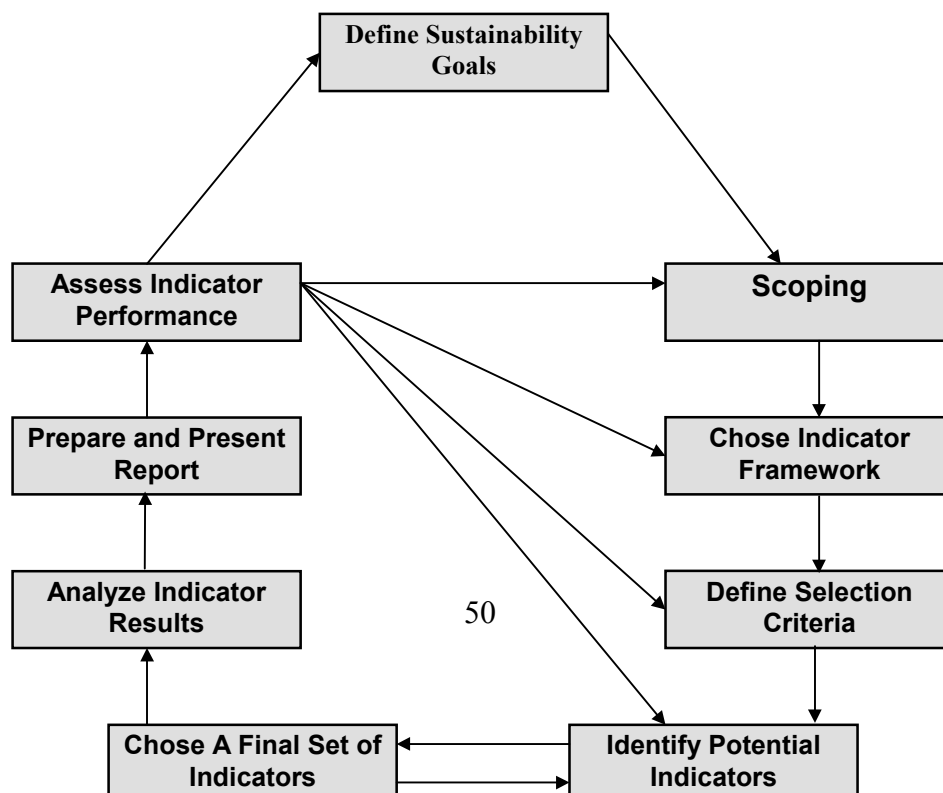
or

- *conditional indicators*, using 'if/then' scenarios to estimate future conditions;
- *distributional indicators*, measuring intra- and inter-generational equity and specifying local, upstream and downstream effects;
- *condition-stress response indicators* (depending on the framework applied) that provide simple causal models for local conditions.

Figure 3.5 illustrates the standard management loop applied to the selection of indicators based on this analysis (by Maclaren), who observes:

"a key question that has yet to be resolved is whether or not it is possible to develop a 'core' set of urban sustainability indicators that could be used by all municipalities in a state, country, or even internationally. Since indicator choices are shaped by community-driven sustainability goals, and these in turn are influenced by local environmental, economic, and social conditions, there may be considerable discrepancies among communities in terms of their preferred indicators" (p.189-190).

Figure 3.5: Steps in the urban sustainability reporting process (Maclaren, 1996)



### *Community Sustainability Auditing*

Brugmann's concern at such findings is that Maclaren's research emphasises not just the differences in need, but the differences in approach, purpose and methodology when attempting to use indicators in all these ways. This complexity is also apparent in research on social matrices applied at community levels: community sustainability auditing. Walter & Wilkerson (1998) identify four benefits which communities can derive from the creation of local sustainability indicators:

- 
- identification of what a community values and prioritising these values;
- accountability of individuals and larger groups for achieving the results wanted by the community;
- enabling people to measure what is important and to make decisions based on these results;
- building democracy through collaboration among people engaged in a community indicator process.

Interestingly, these objectives are focused more on measures of management performance rather than the determination of environmental status, a point which finds an ally in Brugmann. Self-assessment at community level is seen by Walter & Wilkerson as a corrective to the institutionalisation of decision-making by local government. To this end, a community sustainability audit is:

"a systematic, indicator-based procedure for assessing a community's long term sustainability prospects" (Walter & Wilkerson 1998, p.675).

This approach uses a conceptual framework through which to generate a set of questions for the community to answer. These are then used to reveal and assess the community's concern for its sustainability prospects, to identify a set of indicators capable of addressing and measuring these concerns, and to conduct an audit based on this framework. The procedure is not dissimilar in effect to the approach taken by the pilot authorities for the LGMB indicators study, part of which involved consultations with sub-authority local communities (Rowan 1995).

### *City Performance Indicators*

It is difficult not to agree with Brugmann that too much is being expected of these indicators at community and local government level: an educational purpose, a technical instrument to gauge the state of the environment, and a performance management function to evaluate the effectiveness of policy making, delivery and implementation. Confusion between these aims frustrates their effective use for any of these purposes. Santa Monica, Brugmann argues, illustrates how a more focused use of indicators can be put to good effect. A Task Force was set up to establish community priorities on sustainability, following which a programme was developed in which the key elements were:

"eight guiding principles for city decision-making, specific programme goals for each of four policy areas (resource conservation, community and economic development, transportation, and pollution prevention and public health provision) and specific, quantifiable targets to

achieve these goals. A common base year of 1990 and a target year of 2000 was established for each target. Indicators were then established by City staff and Task Force members to evaluate performance in achieving the programme targets. Since the indicators are primarily intended for performance evaluation as opposed to public education, priority was given to the ability of the Division to measure the indicators and to influence their values through municipal programmes" (Brugmann 1996, p.68).

**Table 3.7** offers a selection of the Santa Monica indicators, many of which, as Brugmann observes, were defined simply by the choice of targets. Brugmann concludes that although indicators can serve an educative function in communities yet to be convinced of the need to take sustainability seriously, the use of indicators in helping to deliver effective programmes should take priority:

"since meaningful use of the sustainable development concept implies, sooner rather than later, dramatic and immediate change in local trends, action is the optimal and ultimate response to the challenge. Applications of indicators to support focused actions should be given priority consideration" (ibid., p.70).

Moreover, one can add, the use of indicators to measure performance is often simpler and more precise, because it involves more straightforward considerations, which can often be resolved by examining the nature of the target on which it is to be applied.

**Table 3.7: The Santa Monica Sustainable City Program: selected goals, targets and indicators** (Brugmann, 1997)

Policy Area	Resource conservation		
Goals	<ul style="list-style-type: none"> <li>Promote the conservation technologies and practices and reduce the use of non-renewable resources</li> <li>Develop local, non-polluting, renewable energy, water and material resource, and expand recycling technology in these areas</li> </ul>		
Targets	<ul style="list-style-type: none"> <li>Reduce energy usage by 16%</li> <li>Reduce potable water usage by 20%</li> <li>Reduce solid waste volumes by at least 50%</li> <li>Achieve a 50% average post-consumer recycled and/or tree-free content in all city paper purchases</li> <li>Convert 75% of the city vehicle fleet to reduced-emission fuels</li> <li>Reduce wastewater flows by 15%</li> <li>Increase total number of trees on public property by 350</li> </ul>		
Indicators	1990 (Actual)	1993 (Actual)	2000 (Target)
Energy Usage (non-mobile sources)	4.0 million Btu/year	4.0 million Btu/year	3.36 million Btu/year
Water Usage	14.3 million gallons/year	12.0 million gallons/year	11.4 million gallons/year
Post Consumer Recycled Tree-Free Paper Purchases	Unknown	Unknown	50%
Wastewater Flows	10.4 million gallons/day	8.5 million gallons/day	8.8 million gallons/day

City Fleet Vehicles Using Reduced-Emission Fuels	Unknown	10%	75%
Trees in Public Spaces	28,000 trees	28,000 trees	28,350 trees

Policy area	Community and economic development		
Goals	<ul style="list-style-type: none"> <li>• Encourage the development of compact, mixed-use, pedestrian-orientated projects</li> <li>• Promote the growth of local businesses that provide employment opportunities to Santa Monica residents</li> <li>• Facilitate education programmes that enrich the lives of all members of the community</li> </ul>		
Targets	<ul style="list-style-type: none"> <li>• Provide 750 additional affordable housing units</li> <li>• Create 3 new community gardens</li> <li>• Establish partnerships with local schools to create and compliment a Sustainable Schools Programme</li> <li>• Increase total public open space area by 15 acres</li> </ul>		
Deed-restricted Affordable Housing Units	1172 units	1313 units	1922 units
Community Gardens	2 gardens	2 gardens	5 gardens
Creation of a Sustainable Schools Program	N/A	N/A	Implemented
Public Open Space	164 acres	164.8 acres	180 acres

The Santa Monica performance indicators make little use of social criteria. Although social considerations are incorporated in the LGMB Pilot Study, as already indicated, a more extensive example of their use in this context is provided by the Association of London Government (1997) report on "Agenda 21 for London". This includes a specific element on civic engagement, in response to LA21 requirements to measure the extent of community and social involvement in decision-making at local level. Following an ALG Conference in November 1996, seven task groups were established to develop indicators, targets and action plans in the following key areas of local decision making in London:

- civic engagement
- economic vitality
- mobility and access
- health
- neighbourhood regeneration
- energy
- the natural environment.

The ALG approach is more broadly based than the P-S-R models considered above. In respect of civic engagement, the task force considered that three criteria were central:

- access to information which is meaningful to the lives of Londoners;
- some idea of what Londoners can do with such information;
- feedback from the consultation process, allowing Londoners to understand why decisions are taken in the way they are.

The ALG working group recognised that indicators on civic engagement would be hard to obtain. Efforts were therefore concentrated on establishing a baseline in respect of the above criteria and in using survey instruments to monitor changes from this. The key objective was to establish:

"the level of people's own activities rather than how poorly or well services were provided by local authorities" (p.6).

A "bottom-up" approach was adopted, in the belief that indicators for civic engagement should emerge from work with local communities, supplemented by survey work to establish attitudes towards sustainability and social inclusiveness amongst Londoners. Also considered were possible ways of enhancing civic engagement, such as the use of citizenship juries, surveys, the use of referenda, the establishment of community plans and forums (already initiated by Fife Council), and the extension of advice and information into ethnic languages and braille. **Table 3.8** reflects the viewpoint of members of local government on the ALG to this end. Although an important initiative, the suggested areas in which social indicators can operate represent a narrower view of the purposes of social inclusiveness and civic engagement than has been proposed elsewhere in the literature (see above, Part 2).

**Table 3.8: Indicators for sustainable development for London** (Association for London Government 1997)

{PRIVATE }Indicators of civic engagement
Number of people who have heard of Agenda 21 in London
Number who know who their ward councilors are
Number who know how their local council is funded
Number who know how London Transport is funded
Number who pick up leaflets from their local library or council offices about its activities
Number who understand their rights to entitlements and support services
Number who have taken part in the production of their LA21
Number who have made representations to the council on LA21 issues
Number who are members of a local community group - eg active members of a group or forum concerned with the natural environment
Number who have attended a community group meeting in the last twelve months - eg a protest meeting
Number who have written or spoken to their local councillor or MP about civic issues in the last twelve months
Number involved in the community as a school governor, member of police advisory panel, trades union official or in any similar role
Barriers which prevent people from participating in the above - eg lack of childcare facilities, inaccessible venues, language difficulties
Number of people who do any of the following on a regular basis:
<ul style="list-style-type: none"> <li>• separate waste at home</li> <li>• take separated waste (such as bottles, cans, paper) to a bottle bank or put it out for collection</li> <li>• compost organic waste</li> <li>• use the car less</li> <li>• minimise heating and lighting at home by turning them off when no-one is there, or by insulating windows, etc</li> </ul>
Number of parks/open spaces (including nature reserves etc) where community involvement and management occurs.

### 3.6 Corporate Initiatives

Brugmann's emphasis on the use of indicators for performance measurement leads logically to the final level for which indicators have been developed: the measurement of the performance of organisations. Corporate monitoring and performance indicators pre-date the concept of sustainable development by a long way, and have also been introduced in the public sector (eg Jackson 1998, CAG Consultants 1998). Environmental Performance Management (EPM) is a relative newcomer amongst such tools (James & Wehrmeyer 1996). It does nevertheless fit comfortably with the Anglo-Saxon tradition of quality performance standards, such as TQM and BS 5750, and has as a result spawned a set of related standards (BS 7750, ISO 1400, EMAS).

EPM is still in its early stages at corporate level. Nevertheless, corporate interest is increasing rapidly because of ever-rising statutory obligations, due diligence requirement pressures from shareholders and financial and legal stakeholders, and growing corporate acknowledgement of community responsibilities (as well as a recognition that, as the concept of ecological modernisation emphasises, there are many 'win-win' situations). Few organisations are yet able to measure all their environmentally-related parameters, and even fewer are able to determine the ultimate environmental impacts of their actions. Progress with respect to social impacts is probably even more limited. Nevertheless, as the monitoring and evaluation requirements of the EU Structural Funds programmes begin to bite, and the obligations under the Fifth EAP are felt (Jackson & Roberts 1999), the need for corporate social and environmental performance measurement will continue to increase, as will the need for appropriate indicators to this end.

James & Wehrmeyer (1996) identify five themes underpinning EPM:

- whether EPM activities should focus on indicators that have business as well as environmental significance, or whether they should be driven primarily by environmental considerations;
- whether EPM should be built on a holistic, quasi-scientific, 'cradle-to-grave', consideration of an organisation's environmental impacts, or whether it should be driven by management considerations such as useability and simplicity of concept. The German literature terms these alternatives 'eco-balancing' and 'eco-controlling', and has generally focused on the former, whereas Anglo-Saxon preference has been for the latter;
- whether EPM should be concerned with driving organisations to a pre-determined situation, such as sustainability, or whether limitations of data and methodology favour a more incremental and diverse approach in which EPM is used in organisationally-specific ways to meet organisationally-specific targets. Welford (1993, 1995, 1997) illustrates the switch from advocacy of linking environmental management to quality systems which favour incrementalism towards radical changes in corporate culture to make corporate activities compatible with sustainable development;
- the extent to which EPM is an internally or externally focused activity. EPM to date has been driven by validation and reporting to independently determined standards, and has largely been viewed as akin to financial accounting (Gray et al 1993). More recently, attention has begun to focus more heavily on the management accounting dimensions of EPM, ie the development of indicators to support internal decision-making processes;

- the difference between EPM and green accounting. The application of indicators of sustainable development to the corporate sector has stimulated extensive discussions of the general differences between performance management and accounting (a discussion which needs to be extended to the same topics at national and international levels).

Advocates of EPM argue that measurement activities need to be driven much more by overall strategic objectives as distinct from considerations of financial performance, which tend to characterise green accounting. The standard Anglo-Saxon approach has sought to link EPM with general quality management standards, emphasising the TQM approach. By contrast, corporate approaches towards indicators in Germany have been driven primarily by exacting and extremely difficult regulatory requirements, which have tended to develop the eco-balance and technical aspects of indicators as well as the management performance side. As James & Wehrmeyer (1996) observe:

"Managers need better information on the relative importance of different environmental options, while often complex scientific approaches need to become more consistent and better adapted to the practical needs of management. The answer possibly lies in the production, by internationally consensual methods, of standardised environmental data that organisations can use for their decision-making" (p.121).

Some of the more promising initiatives in this respect are being taken by partnerships charged with directing the use of development funds. Birley (1998) has undertaken research into ways of introducing sustainability into the management systems of the Eastern Scotland European Partnership. The Sustainable Development Project, funded by the EU as a pilot scheme (ESEP,1999), has employed consultants to examine the Partnership's programme. This initially applied a framework based on sixteen areas of action for testing sustainability. On this basis, the programme was found to be on an equal footing with other Objective 2 programmes, all of which suffered similar shortcomings in implementing the EU Fifth EAP.

As a result of further work, twelve core criteria have been identified for project selection which incorporate aspects of sustainability. These are summarised in **Table 3.8**, which illustrates how they relate both to the ECOTECH action areas and to the current SPD core criteria. The next logical step is to develop sustainability performance measures which can be applied to the relevant criteria and which will allow the effectiveness of the programme in fulfilling them to be assessed.

The DETR (1999) is also establishing an evaluation and monitoring framework applicable to the English RDK Development Agencies, for which a core set of indicators is being created. Five categories of indicators have been identified:

- *contextual indicators* providing a broad picture of the region as a backdrop to RDA strategies;
- *influenceable indicators* offering broad measures over which the RDA has direct influence;
- *strategic indicators* measuring the impact of the RDAs' strategic activities;
- *programme indicators* measuring progress on programmes delegated to RDAs;
- *efficiency indicators* relating directly to the RDA as an organisation.

At the same time, Scottish Enterprise is in the process of revising its own performance measuring system, the OMF, to reflect the broadening of its mission statement to encompass sustainability and quality of life considerations. In the following part of the report we consider in the light of our findings in this and the previous part how sustainability indicators which fulfil the task of performance measures may be identified for local and regional development agencies.

**Table 3.9: Evolution of SPD Core Criteria for Project Selection (Birley, 1998)**

Current SPD Core Criteria	ECOTEC 16	5-4-5	Sustainable Development Core Criteria
4 Outcomes - Job Creation		C1 Net Additional Jobs	1 Net Additional Jobs
2 Evidence of Demand		C2 Demand	2 Evidence of Demand
1 Additionality		C3 Leverage	3 Leverage
3 Leverage			
6 Environmental Sustainability	2 Adequate Infrastructure 7 Brownfield Site Development 8 Serviced Site Development 11 Sectors with low Environment Impact 12 Environmentally Responsible Transport 13 IT Applications 15 Spatial Planning	E1 External Resource Impact	4 Infrastructure Impact
	3 Environmental Adjustment for SMEs 4 Eco-Industries 5 Clean/cleaner technology 6 Conservation, Re-use and Re-cycling 9 'Green' Products, Processes and Services 10 Production and Use of Renewables 11 Sectors with low Environmental Impact 13 It Applications 14 Awareness of Sustainability 16 Industrial Ecology	E2 Internal Resource Efficiency  E3 Eco-Industry	5 Resource Efficiency
	1 Enhancing Environmental Quality 14 Awareness of Sustainability	E4 Enhanced Environment	6 Environmental Impact
8 Equal Opportunities		S1 Access	7 Access and Opportunity
		S4 Local Added Value	8 Local Added Value
		S5 Community Participation	
		S2 Skills Development	9 Capacity Building
		S3 Integration Inclusion	10 Social
9 Strategic Integration		C4 Strategic Integration	11 Strategic Integration
5 Outcomes - other		C5 Durability	12 Durability and Feasibility
7 Project Sustainability			

## **PART 4: RECOMMENDATIONS FOR THE DEVELOPMENT AND IMPLEMENTATION OF OPERATIONAL INDICATORS FOR LOCAL DEVELOPMENT AGENCIES**

### **4.1 The Current Scottish Enterprise Context{PRIVATE }**

#### *The Scottish Enterprise Network Revised Strategy*

The Secretary of State's Advisory Group on Sustainable Development in its recent report listing ten action points (Advisory Group on Sustainable Development 1999) identified the need for a specific commitment on the use of indicators by those charged with delivering sustainable development:

#### **"Action Point 6: Set sustainability aims, objectives, targets and timescales**

Sustainable development indicators should become as regular a part of public monitoring information as the unemployment figures" (p.2).

Hitherto, Scottish development agencies have focused their monitoring and measurement systems on the delivery of standard economic targets, such as the value-added criteria embodied in the Scottish Enterprise Output Monitoring Framework (Jackson 1998). The OMF is an example of the adoption of a systematic planning and reporting framework which also offered the capacity to provide performance review, quality assurance and strategic planning roles. This has now been superseded by a new Scottish Enterprise strategic framework (Scottish Enterprise 1998), for which a new set of indicators of performance is being developed. The new strategy entails a broader commitment to development, which emphasises the need for more long term strategic planning, to attain the following four goals:

- the presence of *innovative, far-sighted organisations*, capable of adapting to the many changes they see around them;
- *positive attitudes towards learning and enterprise*, investing in enterprises and people willing to take appropriate risks and accept opportunities;
- *an inclusive economy*, with policies which offer everyone the chance to participate in economic development;
- *a competitive place*, with the right conditions for economic and personal wellbeing, offering those in Scotland many opportunities and a good quality of life, including a healthy and attractive environment. This is seen as central to attracting workers and businesses with the right knowledge and skills (pp.16-17).

Although these goals are basically not incompatible with the pursuit of sustainable development, current development of frameworks for assessing performance in these respects remain heavily influenced by traditional appraisal and evaluative approaches which stress the primacy of short term economic objectives. The reasons for this are understandable and include:

- the existence of commonly accepted methodologies for economic appraisal and evaluation;
- the ease with which such economic tools permit quantitative measurement of targets and outcomes, which support standard 'management by results' practices;

- uncertainty about the processes by which longer-term, less quantifiable, broader objectives central to sustainable development can be integrated into an appraisal and evaluative system still targeted towards short term economic results;
- recognition that such integration will require the questioning of some fundamental development tenets, such as the extent to which the delivery of short term economic objectives can pre-empt the achievement of longer term sustainability (such issues are particularly acute in the Scottish context in respect of energy, waste management and transportation policies). New policy parameters need to be established by the Scottish and Westminster parliaments, before it is realistic to expect a development agency to incorporate them into its performance measurement processes.

### *Developing Performance Measures for the New Scottish Enterprise Strategy*

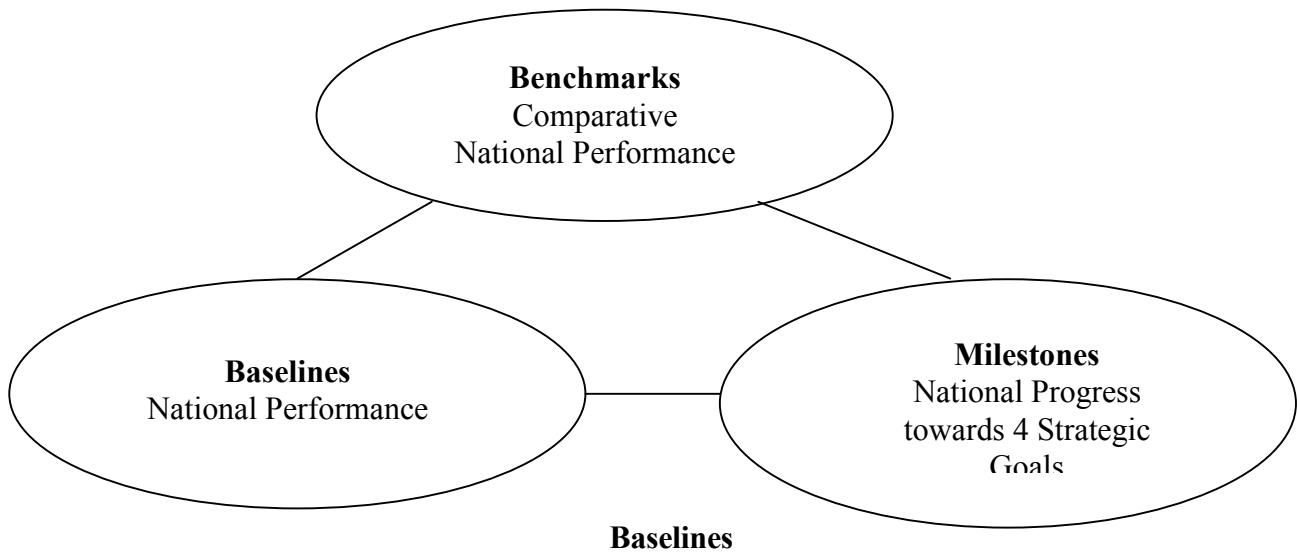
Steps are being taken in this direction. Work is ongoing to integrate a broader monitoring and performance system for Scotland into a new measurement framework for Scottish Enterprise. The summary of such work included in this section presents an overview of the current state of play, which is by no means finalised. The observations made about the suitability of these processes for the delivery of sustainable development should be considered in this context.

**Figure 4.1** provides a schematic summary of the tracking process being proposed for Scotland. This consists of establishing a set of national performance baselines, which are designed to operate alongside comparative benchmarking and the use of staging posts (‘milestones’) monitoring progress towards the four strategic goals within the new Scottish Enterprise strategy (considered also to represent general development objectives for the Scottish economy).

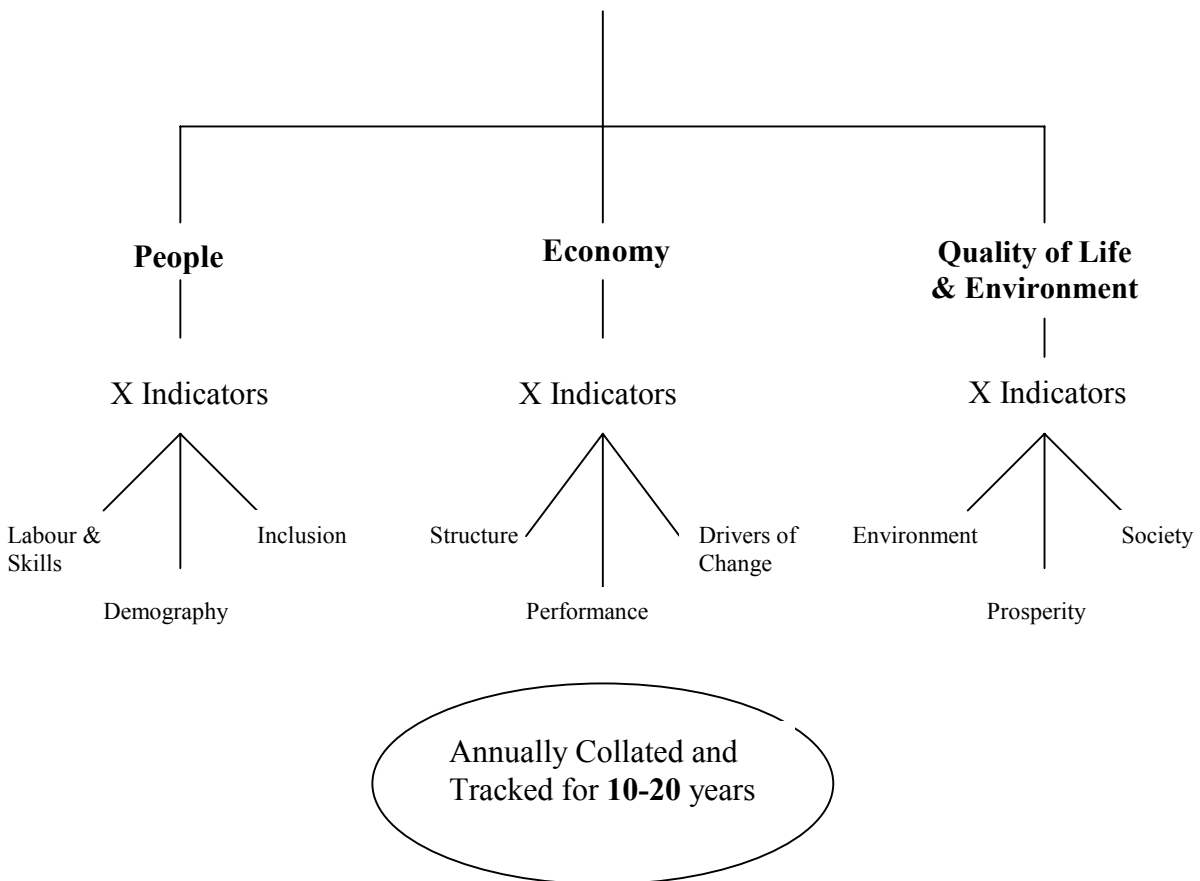
The bottom half of **Figure 1** illustrates how the tracking system for the performance baselines is constructed around three core categories: people, economy, and quality of life and environment. These are then broken down into other sub-categories. **Table 4.1** lists the main and subsidiary indicators (‘baseline measures’) being proposed for tracking the Scottish economy on this basis. Many of the caveats raised in earlier sections of this report apply to this exercise: for example, the extent to which trade-offs are likely between different measures and how these will be resolved in any attempt to provide an overall assessment of performance; the absence of a time horizon, essential for considering sustainability; the lack of a bottom-up community planning perspective, etc. These caveats mainly relate to the use of this tracking device as an appraisal and evaluation tool.

**Table 4.2** lists the other important element in “Tracking the Bigger Picture”: the proposed ‘Milestones’. These are the tracking indicators to be used by Scottish Enterprise and partner organisations in monitoring and evaluating progress at a Scottish level in the delivery of the four strategic goals identified for Scottish development. This table demonstrates that the goals are still being interpreted primarily in terms of traditional measures of economic progress, rather than the linked dimensions of sustainable development. The need for additional relevant environmental indicators is particularly evident.

**Figure 4.1 - Tracking the Bigger Picture** (Scottish Enterprise 1999a)



Tracking system comprising 3 core categories of Indicators divided into 9 sub-categories



**Table 4.1 – Tracking the Bigger Picture (Scottish Enterprise, 1999a)**

Main Measures (35)	Sub-Measures (52)
<b>Measures relating to Economy-Performance</b>	
Change in GDP	<ul style="list-style-type: none"> <li>• Per Capita</li> <li>• Change relative to UK</li> <li>• Incl/excl oil &amp; gas</li> <li>• Manufacturing (gross output)</li> <li>• Services (gross output)</li> </ul>
Labour Productivity	<ul style="list-style-type: none"> <li>• GVA per employee</li> </ul>
Change in Value of Exports	<ul style="list-style-type: none"> <li>• Incl/excl whisky</li> <li>• Incl/excl electronics</li> </ul>
Business Optimism	<ul style="list-style-type: none"> <li>• Insolvencies</li> <li>• New Business Starts</li> <li>• Performance of Reuters/Scotsman 50 Index</li> <li>• Construction Orders</li> </ul>
<b>Measures relating to Economy-Structure</b>	
Number of Enterprises	<ul style="list-style-type: none"> <li>• Per 1,000 persons</li> <li>• Proportion of enterprises by size (small, medium and large)</li> <li>• Proportion of employment in enterprises by size</li> </ul>
Proportion of Workforce self-employed	
Number of European HQs/100,000 population	<ul style="list-style-type: none"> <li>• % manufacturing workforce in foreign-owned plants</li> <li>• Number of Scottish listed companies</li> </ul>
Exports as % of GDP	<ul style="list-style-type: none"> <li>• Exports outwith Scotland</li> </ul>
Employment by sector	<ul style="list-style-type: none"> <li>• GDP by sector</li> <li>• Employment relative to GDP by sector</li> </ul>
<b>Measures relating to Economy – Drivers of Change</b>	
Investment (net capital expenditure)	<ul style="list-style-type: none"> <li>• Value of new FD</li> </ul>
R&D expenditure as % of GDP	<ul style="list-style-type: none"> <li>• Employees in high-tech sectors</li> <li>• R&amp;D expenditure by business, government and education</li> </ul>
% GDP invested in infrastructure	
Gross number of new businesses	<ul style="list-style-type: none"> <li>• Per 10,000 population</li> <li>• Net number</li> <li>• VAT registration/deregistration</li> <li>• Business survival rate (36 months)</li> </ul>
<b>Measures relating to People – Demography</b>	
Change in Population	<ul style="list-style-type: none"> <li>• Migration</li> <li>• Natural Change</li> <li>• Urban/rural split</li> </ul>
Economically active population	<ul style="list-style-type: none"> <li>• Population by age band</li> </ul>
<b>Measures relating to People – Labour &amp; Skills Markets</b>	
Number in Employment	<ul style="list-style-type: none"> <li>• Employment Rate</li> <li>• Full-time/part-time split</li> <li>• Gender split</li> </ul>

Unemployment Rate	<ul style="list-style-type: none"> <li>• Unemployment /vacancy ratio</li> </ul>
HE students/1000 population	<ul style="list-style-type: none"> <li>• Quals at 19 and 21 (SVQs/academic equivalents)</li> </ul>
IIP employers	<ul style="list-style-type: none"> <li>• % of workforce covered</li> <li>• employees receiving vocational training</li> </ul>
Education and Training Outputs (ASCETT)	<ul style="list-style-type: none"> <li>• No. of persons on government training schemes/with employed status</li> </ul>
<b>Measures relating to People – Inclusion</b>	
LTU unemployment rate (12 months +)	<ul style="list-style-type: none"> <li>• Differential in unemployment rates across Scotland</li> <li>• LTU unemployment (24 months +)</li> </ul>
% of households without wage earner	<ul style="list-style-type: none"> <li>• Income support for 2 years +</li> <li>• Council Tax Benefit or Housing Benefit Recipients</li> </ul>
% of workers <half median male earning	<ul style="list-style-type: none"> <li>• % of households below 50% average income</li> </ul>
<b>Measures relating to Quality of Life – Prosperity</b>	
Average weekly household income	<ul style="list-style-type: none"> <li>• sources of income</li> </ul>
Consumer Confidence	
House Prices	
<b>Measures relating to Quality of Life – Social Well Being/Society</b>	
Life Expectancy (male/female/all)	<ul style="list-style-type: none"> <li>• Mortality ratio (UK=100)</li> <li>• Invalidity claimants</li> </ul>
Average weekly working hours	<ul style="list-style-type: none"> <li>• % Adults taking a holiday</li> </ul>
<b>Measures relating to Quality of Life – Environment</b>	
% of houses below tolerable standards	
Vacant and derelict land	<ul style="list-style-type: none"> <li>• Brownfield land brought into use (% of total)</li> </ul>
% of goods lifted by mode	
% of waste recycled	<ul style="list-style-type: none"> <li>• Industrial</li> <li>• Domestic</li> </ul>
Air and water quality	

**Table 4.2 NATIONAL PROGRESS TOWARDS GOALS – Measures for Milestones (\*indicates potential primary measures) [Scottish Enterprise, 1999b]**

Strategic Goal	Sub-Division	Measure for Milestone	Source
<b>Scotland with many innovative, far-sighted organisations</b>	Business base	No. of high growth companies*	SE+HIE+Research
		No. of Scottish global companies	SE (JS)
		Investment levels	Scottish Abstract of STATS (SAOS)
		Exports (value/no. of new exporters)	SO/SCDI
	Research and application of knowledge	Total expenditure on R&D as %GDP	Regional Trends (ONS)
		Gross value added per employee*	SO/DTI
		Employment in high tech sectors	Reg Comp Inds (DTI)
		No. of spin-outs from universities	Current SEO Research (ST)
		Patents registered or research grants to universities	Current SEO Research (ST)
	Networks and change	Start-up rates in key sectors	Comm of Scottish Clearing Banks (CSCB)
		Venture capital activity*	British Venture Capital Assoc
		Levels of JVs, takeovers and foreign acquisitions	Research (Business Insider or Acquisitions Monthly)
		Membership of key bodies and networks eg CBI, SCDI, Export Partnerships, Entrepreneurial Exchange	Research
	<b>Scotland with positive attitudes to learning and enterprise</b>	Attitudes	Private sector attitudes of Scottish skills level
Attitudes to Lifelong Learning*			Research
No. of overseas students studying in Scotland			SAOS
Attitudes towards entrepreneurship			MORI
Interest in starting up a business			MORI
Participation and attainment		No. of companies participating in EBP-type activities	SE + HIE
		No. of companies participating and attaining IIP	IIP Scotland
		No. of students entering tertiary education	SAOS
		% of employees receiving vocational training*	Labour Force Survey
		SVQ attainment	Scottish Quals Authority
Enterprise creation		Gross no. of new businesses*	CSCB
		Business survival rates (36 months)	Regional Trends (ONS)

<b>Strategic Goal</b>	<b>Sub-Division</b>	<b>Measure for Milestone</b>	<b>Source</b>
<b>Scotland where economic development is an inclusive process</b>	Income	% of workers below half median male earnings	Scottish Low Pay Unit
		% of households below 50% average income*	Scottish Household Survey
		% increase in median earnings	Labour Force Survey
	Activity	Unemployment rate	ILO and SO
		Long-term unemployment rate	ILO and SO
		% of households without a wage earner	Scottish Household Survey
		Employment Rate/Economic activity rates*	SO
	Opportunity and integration	Increase in total employment*	Labour Force Survey
		Unemployment vacancy ratio	SO
		Positive outcomes from training schemes	SO+SE+HIE
		Companies involved in New Deal type activities	SO
	<b>Scotland as a competitive place in the world economy</b>	Linkage	Investment in telecoms as % of GDP*
Total journey times to key markets by mode			Research
No. of European HQ bases			TERU (Glasgow Unit)
No. of banks conducting international business			TERU (Glasgow Unit)
Infrastructure		% of GDP reinvested in transport infrastructure*	SO estimates
		Construction orders	SO
		Direct international scheduled flights (weighted)	Research
		% of goods directly exported from Scotland and by mode	SAOA
Image and environment		Value and type of FDI	ONS/LiS
		Migration*	GROS
		Volume of tourism (British/overseas)	Scottish Tourist Board
		Brownfield sites brought into use (% of total)	SO

### *Appraisal, Monitoring and Evaluation Under the Revised Network Strategy*

In parallel with the development of the framework for “Tracking the Bigger Picture”, Scottish Enterprise has been working on a new measurement framework for its own activities which is compatible with the new Strategy. One model which was under active investigation during the drafting of this Report is summarised in abbreviated form in **Table 4.3** below. This approach represents an attempt to link the Network’s general activities across all four goals, as summarised in the column on the right (“How will this happen”), through the changes that these are intended to produce within each specific goal (“Indicators of Change”), to the delivery of appropriate “Indicators of Success” in relation to each of these goals.

The table is adapted from the original, focusing only on those aspects under these headings which appear to be most relevant to the development of indicators of sustainable development. One advantage of applying this approach would be the flexibility to introduce new activities and indicators of change, provided they are contributing towards attaining the indicators of success. Some confusion about the concept of sustainable development is evident in some of the entries. This is most evident in the use of the word “sustainable” to indicate a wish that such provision/conditions continue (which is very different from the question of whether such a goal is sustainable). Apart from those identified here as being pertinent to the delivery of sustainable development, the original version includes many other indicators of economic achievement, and educational and training provision.

Since the initial drafting of this Report, further work has been carried out to develop a framework for gathering and reporting Management Information for the SE Network, which could be implemented for the 2000/2001 planning year. The present approach has moved away from the framework set out in **Table 4.3**, and focuses instead on information about activity and outcomes that can be measured during the planning year, or the subsequent year, with estimated outputs after three years. The emphasis is on outcomes that contribute towards economic impacts, principally jobs and GDP. Estimated outputs should be supported by evaluation work on a range of projects.

The basic framework, which appears to be a simplified version of the original Output Monitoring Framework, is split into:

- GOAL
  - FOR EACH KEY RESULT AREA WITHIN EACH GOAL:
    - Category of activity (e.g. “Grow global companies”)
    - Activity (e.g. “Number of assists”)
    - Outcomes (e.g. “Number of companies achieving global status; Number of new exporters”)
    - Outputs (e.g. “Increase in export sales; Jobs”)

In this approach the only specific coverage of environmental activity is under the Key Result Area “Promoting Environmentally and Socially Sustainable Activity”, within the “Innovative and Far Sighted Organisations” goal. The Activity is the number of assists, and the Outcomes are restricted to the Numbers achieving EMAS / ISO 14001 standards, and Numbers achieving energy savings / waste reductions. No outputs are listed for this KRA, presumably because such changes are not believed to produce conventional business benefits. The resulting

environmental benefits are not regarded as meriting coverage as “Outputs”.

Despite the emphasis within the new SE Strategy on developing integrated projects which contribute towards more than one goal (a fundamental aspect of sustainable approaches), these multiple benefits cannot be recorded in a systematic way within the new framework. The intention is that they should be identified through project appraisal, and picked up through evaluation. In this respect the new guidance for project appraisal from the Scottish Enterprise Projects Advisory Group shows the most significant progress in recognising the need to achieve a better balance between economic development, environmental quality and social equity. This was approved in November 1999, and is intended to apply to all major projects. It includes a “sustainable development appraisal” checklist set out in **Table 4.4**. These guidelines are intended to be indicative, rather than exclusive, and should go some way to building a *practical* understanding of the dimensions of sustainable development amongst project managers. Economic benefits and other considerations are covered by other sections of the guidance. This can be seen to tie in closely with the approach we develop later in this chapter for indicators of sustainable development.

The overall conclusion to be drawn from the review in this section of the work within Scottish Enterprise to develop a framework for strategic measurement, appraisal and evaluation of network activities must be qualified by a recognition much of this is still incomplete. Nevertheless, in respect of sustainable development there is at present a mismatch between the Strategy and the guidance on project appraisal, on the one hand, and the new measurement framework on the other. The measurement framework is still in a process of evolution, however. The basic structure is likely to remain as summarised above, but there should be scope to modify the details, for example by including environmental outputs, and modifying social/inclusion outputs. As sustainable development is not considered as a Goal in its own right, its significance as a cross-cutting integrating theme needs to be recognised and reinforced through the measurement framework.

**Table 4.3: Summary of translation of Scottish Enterprise performance measurements into indicators: *italics indicates those related to sustainable development* (Scottish Enterprise 1999c)**

<p>{PRIVATE }Indicators of success (selected)</p>	<p>Indicators of change (selected)</p>	<p>How will this happen? (all goals)</p>
<p><b>An inclusive economy:</b></p> <p><i>Equality of participation in economic activity;</i></p> <p><i>All Scottish communities thrive and regenerate according to changing economic/social/environmental circumstances;</i></p> <p><i>Range, quality, diversity of communities preserved;</i></p> <p><i>Equitable wealth/prosperity distribution achieved;</i></p> <p><i>Good relatively to others in terms of socio-economic deprivation/lack of inclusiveness</i></p>	<p><b>An inclusive economy</b></p> <p><i>More from disadvantaged backgrounds in work/training;</i></p> <p><i>Better participation by key groups;</i></p> <p><i>Better social participation;</i></p> <p><i>Improved infrastructure support to disadvantaged groups, plus greater economic participation by these;</i></p> <p><i>More awareness among businesses of needs/interests of communities/individuals and greater willingness to respond in terms of jobs/training;</i></p> <p><i>Greater self-sustaining communities through increased skills, knowledge and resources;</i></p> <p><i>Increased community capacity to plan and manage own development;</i></p> <p><i>Improved economic and social connectors to support community development and sustainability.</i></p>	<p>Direct provision and influence on other players to maximise private sector input/involvement;</p> <p>increase range and quality of partners' contributions;</p> <p>provide value for money;</p> <p>maximise integration at strategic and operational levels;</p> <p>maximise contribution to other strategic goals;</p> <p><i>achieve properly balanced intervention recognising economic, social and environment factors;</i></p> <p>maximise effectiveness of network interventions through quality assurance systems.</p>

{PRIVATE }Indicators of success (selected)	Indicators of change (selected)	How will this happen? (all goals)
<p><b>Innovative and far-sighted organisations</b>  <i>Scottish economy regarded as sustainable economic development and social partnership model</i></p>	<p><b>Innovative and far-sighted organisations</b>  <i>Greater understanding by Scottish businesses of impact of economic change on communities and disadvantaged groups;</i></p> <p><i>More shared vision and effective strategic partnerships between Scottish organisations to deliver sustainable, inclusive economy;</i></p> <p><i>More Scottish businesses recognise and act on sustainable environmental responsibilities</i></p>	<p><i>As above</i></p>
<p><b>Positive attitudes towards learning and enterprise</b>  <i>Benefits of learning and enterprise shared across areas and groups.</i></p>	<p><b>Positive attitudes towards learning and enterprise</b>  <i>More Scots, Scottish businesses, other organisations and people coming to Scotland recognise benefits of learning and demonstrate capacity for enterprise and personal development</i></p>	<p><i>As above</i></p>
<p><b>Competitive place</b>  <i>Scotland's communities survive and thrive;</i></p> <p><i>Scotland's prosperity widely distributed;</i></p> <p><i>Characteristics:</i></p> <p><i>High quality of life attained;</i></p> <p><i>High standards and effective use of economic and social connectors, eg:</i>  <i>transport, housing, communications; utilities;</i>  <i>leisure and recreation; industrial property;</i></p> <p><i>Sustainable and responsible land use pattern;</i></p> <p><i>High standards of cultural activity;</i></p> <p><i>High quality of natural environment.</i></p>	<p><b>Competitive place</b>  <b>Increasing/sustained, relevant investment in infrastructure</b></p> <p><i>Increasing quality and sustainability of key natural and built environmental attributes</i></p>	<p><i>As above</i></p>

**Table 4.4: Checklist for sustainable development appraisal (Scottish Enterprise 1999d)**

<p><b>{PRIVATE }Use of resources:</b>          consider the extent to which the project will positively advance business efficiency and growth through efficient use and management of resources, for example:</p> <ul style="list-style-type: none"> <li>- development and use of cleaner and/or innovative technologies</li> <li>- efficient procurement and use of heat and power, water, raw materials, etc</li> <li>- recycling and re-use of materials</li> <li>- waste minimisation policies</li> <li>- use of local suppliers</li> <li>- minimising long-term maintenance and management costs</li> <li>- implementation of environmental management plans</li> </ul>
<p><b>Efficient utilisation of infrastructure:</b>          Consider the extent to which the project will positively impact on infrastructure provision, ie maximising use of existing capacity and considering ways to reduce infrastructure pressure, for example:</p> <ul style="list-style-type: none"> <li>- being close to existing settlements, labour markets, suppliers and public transport</li> <li>- encouraging sustainable transport policies</li> <li>- utilising brownfield or already serviced sites</li> <li>- suing or refurbishing existing buildings</li> <li>- using existing utility capacity</li> </ul>
<p><b>Impact on social inclusion and local participation:</b>          Consider the extent to which the project will positively contribute to social inclusion, for example:</p> <ul style="list-style-type: none"> <li>- removal of constraints to employment</li> <li>- promotion of links between training and business</li> <li>- active participation of local communities in the project</li> <li>- consideration of the long-term viability of projects (eg avoiding future blight)</li> <li>- targeting specific labour groups/markets</li> <li>- enhancing understanding of social responsibility</li> </ul>
<p><b>Impact on the environment:</b>          Consider the extent to which the project enhances or protects the environment or minimises negative impact, for example:</p> <ul style="list-style-type: none"> <li>- protection of species at risk and enhancement of bio-diversity</li> <li>- raising awareness of sustainable development and enhancing learning</li> <li>- promoting visual amenity</li> <li>- positive changes in attitudes to sustainable development policies</li> <li>- contributing to understanding of environmental responsibility</li> </ul>

### *The Bellagio Principles*

The efforts currently being made by the Scottish Enterprise Network to produce effective performance indicators for its activities, which tie specific actions into the strategic goals, lack a clear appreciation of the significance of sustainable development and its implications for the normal activities of development agencies. The only indisputable evidence that this has been adequately absorbed is to be found in the project appraisal guidelines listed in **Table 4.4**.

It may therefore be helpful to consider at this point a statement designed to provide practitioners with a clear set of guidelines on how to incorporate sustainable development in the overall process of policy, programme and project assessment. This has come to be known as the *Bellagio Principles*, after the meeting place in Italy, where under the auspices of the Rockefeller Foundation in late 1996, an international group of measurement practitioners and researchers endorsed unanimously a set of guidelines to this end.

The full list is set out in **Table 4.5**. The ten principles can be grouped into four management stages:

- *Principle 1* is the "mission statement" from which subsequent assessment of progress can be made. Without a clear mission statement acknowledging and accepting the objectives of sustainable development, subsequent progress by the decision-making unit responsible becomes difficult.
- *Principles 2-5* provide the content of any assessment system for sustainable development. They focus on the need to combine an appreciation of the overall system needed for sustainability with the practicalities of focusing on priority issues.
- *Principles 6-8* identify the key issues in any system of assessment.
- *Principles 9-10* acknowledge the need for a capacity to evaluate and report on progress to this end.

There are perceptible echoes in these principles of the standard EMAS (Eco-Management and Audit) and other quality assurance schemes developed for environmental standards. Indeed, it is not difficult to envisage the construction of a specific management standard dealing with sustainable development along these lines, which could be adapted by relevant bodies to their own needs. In the absence of such a standard at present, and given the abundance of economic indicators already deployed to assess the new Scottish Enterprise strategy, the remainder of this chapter will focus on ways in which to develop and introduce social and environmental indicators of sustainable development more fully into the Scottish Enterprise management assessment process.

**Table 4.5: The Bellagio Principles (International Institute for Sustainable Development 1997)**

<p><b>1. Guiding vision and goal</b> Assessment of progress towards sustainable development should be guided by a clear vision of sustainable development and goals that define that vision.</p>
<p><b>2. Holistic perspective</b> Assessment of progress towards sustainable development should: - include a review of the whole system as well as its parts - consider the wellbeing of social, ecological and economic sub-systems, their state as well as the direction and rate of change of that state, of their component parts, and the interaction between parts - consider both positive and negative consequences of human activity, in a way that reflects the costs and benefits for human and ecological systems, in monetary and non-monetary terms</p>
<p><b>3. Essential elements</b> Assessment of progress toward sustainable development should: - consider equity and disparity within the current population and between present and future generations, dealing with such concerns as resource use, over-consumption and poverty, human rights, and access to services, as appropriate - consider the ecological conditions on which life depends - consider economic development and other, non-market activities that contribute to human/social wellbeing</p>
<p><b>4. Adequate scope</b> Assessment of progress toward sustainable development should: - adopt a time horizon long enough to capture both human and ecosystem time scales thus responding to needs of future generations as well as those current to short term decision- making - define the space of study large enough to include not only local but also long distance impacts on people and ecosystems - build on historic and current conditions to anticipate future conditions: where we want to go, where we could go</p>
<p><b>5. Practical focus</b> Assessment of progress toward sustainable development should be based on: - an explicit set of categories or an organising framework that links vision and goals to indicators and assessment criteria - a limited number of key issues for analysis - a limited number of indicators or indicator combinations to provide a clearer signal of progress - standardising measurement wherever possible to permit comparison - comparing indicator values to targets, reference values, ranges, thresholds, or direction of trends, as appropriate</p>
<p><b>6. Openness</b> Assessment of progress toward sustainable development should: - make the methods and data that are used accessible to all - make explicit all judgements, assumptions, and uncertainties in data and interpretations</p>
<p><b>7. Effective communications</b> Assessment of progress towards sustainable development should: - be designed to address the needs of the audience and set of users - draw from indicators and other tools that are stimulating and serve to engage decision-makers - aim, from the outset for simplicity in structure and use of clear and plain language</p>
<p><b>8. Broad participation</b> Assessment of progress toward sustainable development should: - obtain broad representation of key grass-roots, professional, technical and social groups, including youth, women. and indigenous people to ensure recognition of diverse and changing values - ensure the participation of decision-makers to secure a firm link to adopted policies and resulting action</p>
<p><b>9. Ongoing assessment</b> Assessment of progress toward sustainable development should: - develop a capacity for repeated measurement to determine trends - be iterative, adaptive, and responsive to change and uncertainty because systems are complex and change frequently - adjust goals, frameworks, and indicators as new insights are gained - promote development of collective learning and feedback to decision-making</p>
<p><b>10. Institutional capacity</b> Continuity of assessing progress toward sustainable development should be assured by: - clearly assigning responsibility and providing ongoing support in the decision-making process - providing institutional capacity for data collection, maintenance, and documentation - supporting development of local assessment capacity</p>

## 4.2 The Suggested Approach

As can be seen from the discussions in Parts Two and Three, a wide choice of approaches and procedures exists in relation to the selection and application of indicators of sustainable development. Our recommendations attempt to distil the lessons of the analysis undertaken in these chapters and of the current state of play with respect to developing a measurement framework for the network outlined in the first section of this Part of our report, and to apply these to the selection of indicators that can be developed and applied by SET.

Although we would recommend that SET seeks to operationalise a shorter rather than longer list of indicators - for the sake of clarity and economy in the use of resources - we offer a wider range of potential indicators from which the final selection can be made.

## 4.3 Criteria for the Selection of Indicators

**Table 4.5** above sets out the agreed Bellagio principles designed to provide practitioners with a clear set of guidelines for incorporating sustainable development into policy, programme and project appraisal and evolution. In terms of performance indicators, these principles stress the need for:

- an explicit set of categories linking vision and goals to indicators and assessment criteria
- a limited number of key issues for analysis
- a limited number of indicators of progress
- standardised measurement
- relating indicator values to geographic targets (principle 5)

For such a management tool to provide an effective means of delivering sustainable development, the Bellagio principles also emphasise the need for:

- ongoing assessment (principle 9)
- and
- development of an ongoing capacity to incorporate the results of such assessment into the decision-making process (principle 10).

Our proposals seek to provide a framework capable of meeting these principles, tying into the broader goals and objectives for Scottish Enterprise outlined in Section 4.1. As our review of Scottish Enterprise goals and objectives has indicated, two levels of management are involved:

- strategic goals for the Scotland, the achievement of which involves successful co-operation with a wide range of partners engaged in the promotion of Scottish development;
- specific programme goals set by Scottish Enterprise for its own activities, which enable its own performance to be monitored and evaluated.

This suggests that in considering indicators of sustainable development, we should be concerned to distinguish between:

- *contextual indicators*, which enable the attainment of broadly agreed strategic objectives to be monitored for their impact upon sustainable development objectives - such indicators will be developed by Scottish Enterprise/SET in consultation with other regional and national partners such as local authorities, SHH and other public, private and voluntary sector bodies;
- *influenceable indicators*, which can be applied to measure the performance of Scottish Enterprise programmes - and in this case, specifically SET programmes - in delivering the sustainable development objectives under its influence and, as a consequence, the achievement of individual ‘client’ organisations.

The ‘long list’ of indicators proposed in the following section uses this operational distinction. The contextual indicators provide a gauge of overall progress within Scotland towards the goals of sustainable development. The influenceable indicators offer tools which can be incorporated within the management performance framework of Scottish Enterprise itself. We apply the criteria broadly identified at the start of this report for selecting suitable indicators for both purposes:

- clear
- targeted
- effective
- relevant
- balanced
- long-term

Given the abundance of economic indicators already deployed within the Scottish Enterprise strategy, our focus is on identifying suitable environmental and social indicators which can be used alongside the traditional economic criteria. Once agreed sets of indicators for sustainable development are applied to the Scottish Enterprise Network, it follows that a modified system of appraisal and evaluation will need to be adopted to take these fully into account in selecting, monitoring and assessing progress in this respect.

Ideally, the indicators should fit into the Scottish Enterprise strategy framework, but not be constrained by it, so that if there are important indicators that do not completely fit, they should be included where most appropriate. This should allow a flow from strategy to project as follows:

- 4 goals
- contextual indicators
- influenceable indicators
- specific SET performance measures
- project-specific measures

The tables provided at the end of this chapter reflect this process. Two additional points must be considered:

- Which, if any, indicators can be identified that reflect a policy action or activity that can be

influenced by or attributed to SET?

- How can SET ensure that the indicators which it selects will be accepted by other organisations both within the Tayside area and elsewhere?

The first of these considerations can best be addressed by SET staff, whilst the second point may be an issue for discussion with other parties. Irrespective of the final list of indicators selected, it will be essential to ensure that both of these points are satisfied.

#### **4.4 A 'Long List' of Indicators**

In proposing the following 'long list' of contextual and influenceable indicators, the authors are aware that not all of the indicators are applicable to all economic activities and to all members of the resident or employed population. However, most of the suggested indicators are applicable to most activities.

Some indicators may share the characteristics of both the contextual and influenceable categories.

##### *Contextual Indicators*

Some examples for the 'long-list' of contextual indicators to which SET will wish to contribute, together with an indication of the links to other key indicator sets, are provided below. The examples of links are of considerable importance, because such links illustrate the 'nesting' of policy objectives and indicators. It is important that the indicators selected by SET relate to those used at other spatial levels. Some examples of indicators include:

- journey-to-work - a reduction in the use of private cars for journey-to-work and an increase in the use of walking, cycling and public transport (this indicator is linked to many indicator sets, including DETR, 1998a and OECD, 1998);
- water use and quality - an improvement in river quality (over 96% of the river network in Scotland is assessed as of good and fair quality) and a reduction in the number of reported water pollution incidents (this is linked to various indicator sets, including DETR, 1998a and Bell et al 1997);
- waste generation and disposal - to reduce the amount of industrial and commercial waste sent to landfill (some 80% of waste in the UK comes from industry, construction and demolition and over 60% of the total amount of waste is disposed of in landfill sites). This indicator will have to be discussed and calibrated through negotiation with a range of other stakeholders (linked to OECD, 1998; DETR, 1998a; Bell et al 1997);
- the re-use, in general terms, of brownfield land and buildings - this is an indicator that reflects both the direct use of a resource (open greenfield land) and the indirect use of energy (much brownfield land is in existing urban areas), but it also reflects the beneficial re-use of premises that might be either unused or under used (linked to DETR in a variety of statements; Moldan, 1997);
- air pollution and air quality - reduction in the number of days of recorded pollution (linked

to DETR, 1998a; OECD, 1998, Bell et al 1997);

- overall energy consumption - although difficult to attribute and measure, this can be used as a general indicator of growing awareness and action related to the conservation of fossil fuels and other energy sources (linked to most lists including OECD, 1998; DETR, 1998a; Bell et al 1997);
- enhancement of educational attainment levels, especially in disadvantaged communities (linked to DETR, 1998a);
- general improvement in public safety and reduction in crime (linked to Bell et al 1997);
- reduction in the number of persons in receipt of benefits (linked to Bell et al 1997);

These and other indicators are incorporated within the second column of **Table 4.6**. This table relates the contextual indicators, on the one hand, to the Network goals to which SET operates and, on the other hand, to the influenceable indicators and performance measures that may be selected.

#### *Influenceable Indicators*

Some examples of influenceable indicators are given below:

- transport mode used for the movement of activity-based materials and products - this should be developed at the level of the individual firm and should seek to identify all transport movements by mode and distance;
- water use and discharge quality improvements - the total amount of water used, the percentage recycled and the amount sent to drain;
- energy savings at the level of the individual firm - this would include all forms of energy used;
- incorporation of energy efficiency measures in the design/adaptation/renewal of buildings;
- waste reused and recycled - this would examine and measure the waste stream in an individual firm and the amount reused, recycled and sent for disposal;
- collaboration in the purchase, supply and safe disposal of all materials;
- use of existing premises for new activities and the use of brownfield land for the building of new premises, and the conservation and reuse of heritage;
- assessing and tracing the characteristics and sources of materials used in buildings and in the production of goods and services;
- introduction of environmental auditing and assessment as part of the routine management of

a firm;

- introduction of new or redesigned products and devices that are targeted in relation to the market for environmental goods and services;
- provision of environmental awareness education and training for employees and the wider public;
- contribution made to biodiversity;
- employment of local labour, especially those from the immediate vicinity and/or from areas experiencing high unemployment and/or social exclusion;
- provision of training to vulnerable and disadvantaged groups in the workforce;
- provision of support for improvement of community facilities;
- enhancing the active participation of local communities in projects;
- contributions to the reduction of both workplace and town centre area crime;

The relationship between these indicators, the contextual indicators and the specific SET performance measures is again shown in **Table 4.6**. It is important to note that although some of these indicators are linked to the indicators used in other research and policy documents, the real purpose in listing these suggestions is to allow SET to define measures that it considers suitable and to negotiate the application of those measures which satisfy the requirements of SET and its partners.

Following discussion and agreement on the selected short-list of indicators, advice can be provided on possible units and methods of measurement. It is important to be aware of the difficulties that are likely to be encountered in relation to the use of the suggested indicators, on the influenceable list.

#### **4.5 Developing the Influenceable Indicators**

Although it is not suggested that the full list of influenceable indicators proposed in Section 4.4 should be put into effect, it is helpful to consider how such indicators can be developed from an aspiration to a practical means of measuring progress towards the achievement of the objectives of sustainable development. Once a final list has been selected from the long list of influenceable indicators, each of the chosen indicators will be elaborated. Examples of such elaborations are included in **Table 4.6**. It is proposed that SET should set a context for each indicator that will enable a client organisation or individual to develop and agree specific performance targets and how such targets should be measured. These targets would, of course, be subject to review and calibration against established norms or standards of performance. To do otherwise would run the risk of either making a task almost impossible (if an unrealistic or difficult-to-achieve target is specified) or too easy (if the target is at or near an existing level of performance). The 'one-size-fits-all' approach to the application of influenceable indicators is

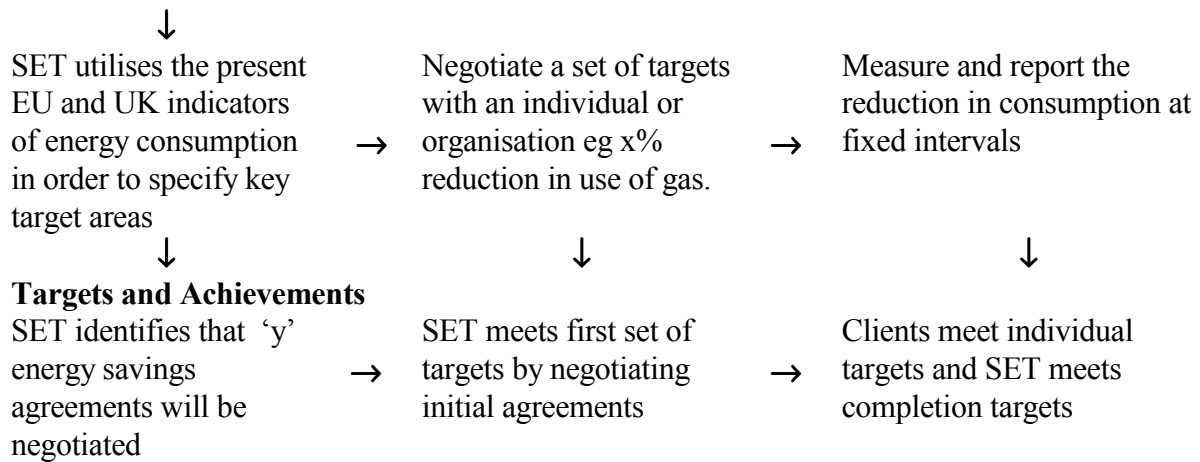
not recommended in this report. Two examples of how an indicator can be agreed, calibrated and put into practice – what can be done as a ‘tailored-to-fit’ approach - are provided below:

- first, an example of energy savings strategy and its measurement (example A);
- second, the use of environmental auditing and assessment (example B).

Both of these examples are now discussed.

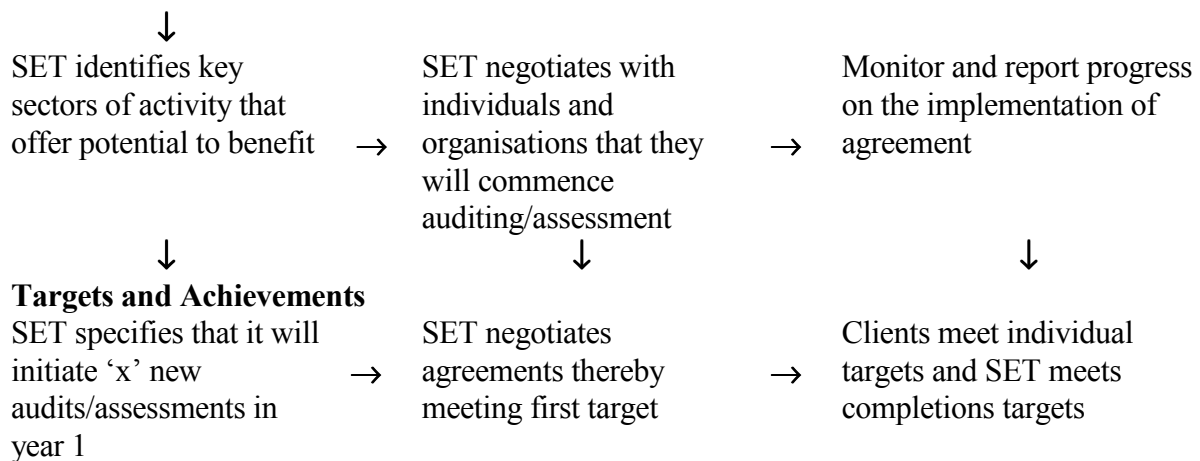
### Example A

#### Energy Savings Strategy and Measurement



### Example B

#### Introduction of Environmental Auditing and Assessment



## 4.6 Using the Indicators

As was noted earlier in this report, there is always the potential for conflict between objectives in the design and operation of sustainable development. policies. A similar tension exists in relation to the specification of indicators. However, whilst such tensions may exist, they do not

undermine or diminish the need to provide full coverage of the range of factors that are encapsulated in the term sustainable development. Sustainable development itself is a difficult concept and contains many internal contradictions; equally, the indicators used to measure progress towards the achievement of sustainable development objectives will reflect many of these contradictions.

There are a number of ways in which SET can use the indicators. The contextual indicators can be used to guide SET's contributions to:

- a range of partnership initiatives from local to national level;
- general programmes at regional, local and neighbourhood levels;
- overall national performance;
- reporting SET's contributions and performance.

A 'core' set of indicators may be selected if so desired.

The influenceable indicators can be used to measure SET's contributions and activities, including:

- influencing partner organisations;
- influencing the behaviour of individual firms and other institutional clients;
- influencing and training individual persons;
- conducting appraisals of applications for financial and other forms of assistance and in relation to other project proposals;
- contributing to general social and environmental welfare;
- assessing and reporting on SET's performance at all levels - national, regional and local.

Once again a 'core' set of indicators may be selected.

In addition to these specific measures that are related to SET's use of the indicators, the overall effect of using the indicators can be assessed. This will require SET to collaborate with other partner organisations in the design and operation of an agreed assessment framework

Furthermore, the growing importance of Community Planning as a form of corporate territorial planning and management should be acknowledged, and the requirements of the other partners in the regional 'community' with regard to the selection of sustainable development indicators should be identified. Given the importance attached to the measurement of progress through partnership in order to demonstrate the benefits of collaboration, it would be unwise for SET to pre-empt the preferences of other regional 'community' partners through a premature selection of a set of contextual indicators, to which SET and other partners will contribute. However, the influenceable indicators can be selected chiefly by SET, although reference may be made to partners in order to incorporate their views in the final selection process.

Finally, it would appear sensible for SET staff to set the pattern of behaviour for others to follow, by identifying and implementing a package of influenceable indicators and specific targets/measures that can be applied to its own operations. A responsible organisation should welcome the opportunity to set the pace for the implementation of a sustainable development

approach in all of its activities; SET will strengthen its hand in many ways through the adoption of such an approach

**TABLE 4.6 PROPOSED INDICATORS – THE FLOW FROM STRATEGY TO PROJECTS**

Network Goals	Contextual indicators (* core indicators)	Influenceable indicators (* core indicators)	SET performance measure	Project-specific measure (indicative examples)
<p><b>I</b></p> <p><b>FSO</b></p>	<p>Journey to work</p> <p>*Water use and quality</p> <p>*Waste generated and split by modes of disposal</p> <p>*Energy consumption</p> <p>*Employment in environmental industries and services</p>	<p>*Transport mode for movements of people, materials and products</p> <p>Water discharge quality improvements</p> <p>*Waste re-used and recycled/disposed of by individual firms</p> <p>Collaboration in purchase, supply and disposal of materials</p> <p>*Energy savings by firm</p> <p>Assessing/tracing the characteristics and sources of materials used in [buildings] and production of goods and services</p> <p>*Introduction of environmental auditing ad assessment as part of routine management of a firm</p> <p>*Introduction of products targeted at markets for environmental goods and services <u>inc. recycling/repair</u></p>	<p>Several of these indicators could be covered by the number of organisations with which we agree targets + the overall shift/improvement in resource use etc that should result</p> <p>i.e. we would work towards:</p> <ul style="list-style-type: none"> <li>• number of organisations introducing EMAS as a result of our intervention (and the number of account managed cos. with EMAS)</li> <li>• number of organisations with which we agree specific resource management, local purchasing, or transport targets</li> <li>• actual quantifiable targets for improvements in energy consumption, waste management, shifts of people &amp; materials by mode, etc)</li> </ul> <p>Number of companies assisted to introduce products/services for the environmental market.</p>	<p>Shift in volumes and distances by transport mode for each organisation + efficiencies resulting</p> <p>Shifts in waste handling from disposal to reuse or recycling for each organisation</p> <p>Reductions in energy consumption ratio to output for each organisation Programme of specific changes to materials sourcing to reduce environmental impacts through the life cycle.</p> <p>Milestone dates for initial commitment, assessment, and review.</p> <p>Development and launch dates for new products and services, market penetration targets and performance.</p>

<b>Network Goals</b>	<b>Contextual indicators (* core indicators)</b>	<b>Influenceable indicators (* core indicators)</b>	<b>SET performance measure</b>	<b>Project-specific measure (indicative examples)</b>
<b>Learning &amp; Enterprise</b>	<p>*Education and training attainment levels</p> <p>Levels of environmental awareness</p>	<p>*Provision of environmental awareness training for employees and the wider public</p> <p>*Percentage of those in employment receiving formal training</p>	<p>Incorporation of environmental modules into training programmes and company-specific training</p> <p>Percentage of employees in account-managed companies receiving formal training</p>	<p>Numbers of employees receiving training in environmental and community awareness, and appropriate technical expertise where required.</p>
<b>Inclusive Economy</b>	<p>*Reduced nos. receiving benefits</p> <p>*Levels of dereliction of community and residential facilities</p> <p>Strengths and “capacity” of community groups and organisations</p>	<p>Employment of local labour, esp those from immediate vicinity and/or areas of high unemployment etc</p> <p>*Number of organisations with active “inclusion” policies</p> <p>*Provision of training to vulnerable and disadvantaged groups</p> <p>Support for improvement of community facilities</p> <p>*Enhancing active participation of local communities in projects</p> <p>*Employment in the social economy</p> <p>Health of the “social economy”</p>	<p>Numbers from target groups employed in key projects</p> <p>Number of key account companies with active “inclusion” policies</p> <p>Penetration of training programmes within target groups, and measures of success (inc. pre-vocational milestones.</p> <p>Projects involving improvements to community facilities (inc.training programme projects)</p> <p>Number of social economy organisations assisted</p> <p>Number of community based financial services schemes assisted</p> <p>Initiatives supporting home working</p>	<p>Numbers from target groups employed in key projects</p> <p>Number of companies participating in specific business groups / initiatives</p> <p>Numbers / percentages achieving pre-vocational milestones</p> <p>Facilities refurbished / brought back into use</p> <p>Community involvement in project implementation and ongoing management</p> <p>Numbers given management training, organisational development plan in place, being implemented.</p> <p>New community service established / performance targets</p>

<b>Network Goals</b>	<b>Contextual indicators (* core indicators)</b>	<b>Influenceable indicators (* core indicators)</b>	<b>SET performance measure</b>	<b>Project-specific measure (indicative examples)</b>
<b>Competitive Place</b>	<p>*Take of land by greenfield/brownfield split</p> <p>Housing quality and affordability</p> <p>Educational infrastructure and standards</p> <p>Healthcare infrastructure and standards</p> <p>*Public transport usage</p> <p>*Habitat and biodiversity changes</p> <p>*Public safety and reduction in crime</p> <p>*Strong and distinctive local culture</p> <p>*Pride in the local community, and resulting social/environmental responsibility</p>	<p>*Use of existing premises for new activities and use of brownfield land for building new premises</p> <p>*Energy efficiency in design/adaptation/renewal of buildings (both commercial and domestic)</p> <p>Assessing/tracing the characteristics and sources of <i>materials</i> used in buildings (and production of goods and services)</p> <p>Contribution made to biodiversity</p> <p>Contributions to reduction of workplace and town centre crime</p> <p>Conservation and re-use of heritage</p> <p>Support for distinctive local culture</p> <p>*Quality of public open space/civic space</p> <p>*Improved and managed public access to the countryside</p>	<p>Proportion of projects, and of land area developed, utilising brownfield land and buildings and greenfield</p> <p>Standards achieved in projects for which directly or indirectly responsible</p> <p>Proportion of materials sourced locally (within x miles radius of site)</p> <p>Number of projects which enhance biodiversity (inc company projects)</p> <p>Number of public safety initiatives in which LEC is directly involved</p> <p>Number of projects conserving recognised heritage (eg listed buildings and sites)</p> <p>Number of projects supporting local cultural activities</p> <p>Hectares improved for public amenity</p> <p>Km of footpaths/cycleways provided</p>	<p>Proportion of land area in the project to come from brownfield, remediation steps to be achieved</p> <p>Energy efficiency targets incorporated in design spec. Increased awareness of design consultants and contractors.</p> <p>Proportion of materials sourced locally (within x miles radius of site)</p> <p>Links to public transport provision, service frequency, eventual usage targets</p> <p>Targets for species populations in project area</p> <p>Improvements in crime statistics; improved public perception</p> <p>Future use of conserved buildings</p> <p>Attendance at cultural events</p> <p>Improved public perception of local amenity</p> <p>Completion dates, community involvement in projects, usage levels.</p>

Network Goals	Contextual indicators (* core indicators)	Influenceable indicators (* core indicators)	SET performance measure	Project-specific measure (indicative examples)
<b>General</b>	<p>Empowerment and self-belief of communities</p> <p>Overall environmental and social impact of public expenditure</p> <p>Best value for money</p>	<p>Active participation of local communities</p> <p>*Public agencies following environmental good practice</p> <p>Number of projects which have multiple benefits against the three dimensions of SD</p>	<p>Sustainable development targets incorporated into Community Planning (inc rural strategy, city partnerships) with genuine local involvement</p> <p>Commitment by SET to achieving EMAS (leading in due course to accreditation)</p> <p>Cross-goal targets for the organisation and for individual teams</p>	<p>Number / means of consultation and involvement, numbers involved, levels of satisfaction with the process</p> <p>Target dates for staff awareness &amp; assessment, targets for specific improvements, e.g. energy usage, materials sourcing.</p> <p>Multiple targets for each project</p>

## 4.7 Conclusions

Although this study has demonstrated that there are many difficulties to be faced in the construction and implementation of indicators of sustainable development, it is also clear that this is a worthwhile exercise and that the benefit of developing a set of operational sustainable development indicators exceed the costs involved. In particular, the study demonstrates the validity of the established principle: if you cannot measure it, you cannot manage it (Roberts 1995). This principle has been used to justify the introduction of sustainable development measurements in business, government and voluntary sector activities throughout the world.

As has been indicated in Parts 2 and 3 of this report, considerable advances have been made in recent years in terms of the relevance and ease-of-use of sustainable development indicators. These advances have demonstrated the benefits provided to all parties from the preparation and use of more sophisticated and better targeted indicators. A particular point of emphasis in much of this recent work has been the need to relate the overall achievement of sustainable development to the operational conditions associated with an individual business, agency or community activity. It is for these and other reasons that we propose the adoption of a two-tier approach to the development and implementation of sustainable development indicators.

At a level which reflects the role performed by Scottish Enterprise/SET in relation to the wide range of other regional partners involved in the delivery of sustainable development, we suggest the need to develop a set of contextual indicators. These indicators will enable the attainment of broadly agreed strategic objectives to be monitored for their impact on sustainable development. Such indicators will be developed in consultation with other regional and national partners.

A second set of indicators should be developed in order to reflect the direct influence exerted by Scottish Enterprise/SET over 'client' organisations. Furthermore, these indicators should be constructed in a manner which allows them to be calibrated to the requirements of an individual organisation. Rather than imposing a 'one-size-fits-all' approach, which in many cases will be inappropriate and unhelpful, a 'tailored-to-fit' approach is suggested which makes use of a standard list of influenceable indicators.

Finally, it is considered important that Scottish Enterprise/SET should set the pace and standard of behaviour by adopting and using both contextual and influenceable indicators to chart the future pathway of performance and to monitor progress.

## **BIBLIOGRAPHY ON INDICATORS OF SUSTAINABLE DEVELOPMENT**

Adriaanse A (1993) *Essential environmental information: the Netherlands* The Hague, Ministry of Housing, Physical Planning and Environment

Agyeman J & Evans B eds (1994) *Local environmental policies and strategies* London, Longman

Alexander J M & McNicoll I H (1995) "Social accounting matrices - an extension of the Scottish 1989 Input-Output Analysis", *Scottish Economic Bulletin* **51**, 29-46

Anderson V (1991) *Alternative economic indicators* London, Routledge

Association of London Government (1997) *London Agenda 21: sustainability indicators, targets and action plans 1997* London, ALG

Atkinson A (1995) *Sustainable Seattle: indicators of sustainable community 1995* Seattle, Sustainable Seattle

Atkinson G, Dubourg R, Hamilton K, Munasinghe M, Pearce D, Young C (1997) *Measuring sustainable development: macroeconomics and the environment* Cheltenham, Edward Elgar

Azzone G & Manzini R (1994) "Measuring strategic environmental performance" *Business Strategy and the Environment* **3**(1), 1-14

Bartelmus P (1994) *Environment, growth and development - the concepts and strategies of sustainability* London, Routledge

Barton H & Bruder N (1995) *A guide to local environmental auditing* London, Earthscan

Bell D, Gibson S, Newby L, Jeffcote M (1997) *Getting better all the time: practical ideas for local sustainability indicators* Leicester, Environ

Birley T (1998) *The sustainable development project: consultation report* Dunfermline, East of Scotland European Partnership

Bowers J (1997) *Sustainability and environmental economics: an alternative text* Harlow, Longman

Brugmann J (1997) "Is there a method in our measurement? The use of indicators in local sustainable development planning" *Local Environment* **2**(1), 59-72

Burbridge V & Robertson S (1978) *Rural indicators study: indicators relevant to the assessment of socio-economic problems and priorities in rural Scotland* Edinburgh, Scottish Development Department

CAG Consultants (1998) *Integrating sustainable development into Best Value: preliminary guidance - main report* London, Local Government Management Board

- Carr M (1998) "Public participation in creating sustainability indicators" *LARIA News* **58**, 6-8
- Commission of the European Communities (1992) *Towards sustainability: a European Commission Programme of policy and action in relation to the environment* Luxembourg, CEC
- Cobb C & Cobb J (1994) *The green national product* Langham Md, University of Americas Press
- Colleran A & Atkinson A (1998) "Taking the right measures" *Scotland's 21 Today* Jan/Feb, 8-9
- Common M (1995) *Sustainability and policy: limits to economics* Cambridge, Cambridge University Press
- Council for the Protection of Rural England (1998) *What you measure matters: a green approach to competitiveness* London, CPRE
- Daly H E (1977) *Steady state economics* San Francisco, Freeman
- Dasgupta P (1995) "Optimal development and the idea of net national product" in Goldin I & Winters L A eds *The economics of sustainable development* Cambridge, Cambridge University Press
- Department of the Environment (1996) *Indicators of sustainable development for the United Kingdom* London, HMSO
- Department of Environment, Transport and the Regions (1998a) *Sustainability counts: consultation paper on a set of 'headline' indicators of sustainable development* Wetherby, DETR
- Department of Environment, Transport and the Regions (1998b) *Prescott launches first ever quality of life barometer* Press Release 991, London, DETR
- Department of Environment, Transport and the Regions (1999a) *A better quality of life: a strategy for sustainable development for the United Kingdom*, Cmnd.4345, London, Stationary Office.
- Department of Environment, Transport and the Regions (1999b) *Quality of life counts: Indicators for a strategy for sustainable development for the United Kingdom*, London, DETR
- Development and Planning Services (1996) *The green report: sustainability indicators for Central Region 1996* Stirling, Central Regional Council
- Dundee City Council (1998) *Planning for sustainability: Dundee LA 21 programme review* Dundee, DCC
- Dundee Sustainability Forum (1997) *A vision for sustainable development in Dundee* Dundee, DSF
- Economic Planning and Development Department (1995) *Sustainability indicators project: summary and recommendations* Glenrothes, Fife Regional Council
- EKOS (1998) *Eastern Scotland Objective 2 Programme 1997-99: programme baseline and performance indicators, Final report* Glasgow, EKOS

- ESEP (1999) *The Sustainable Development Project: Final Report*, Dunfermline, Eastern Scotland European Partnership.
- Eurostat (1997) *Indicators of sustainable development: a pilot study following the methodology of the United Nations Commission on Sustainable Development* Luxembourg, CEC
- Faucheux S & O'Connor M eds (1998) *Valuation for sustainable development: methods and policy indicators* Cheltenham, Edward Elgar
- Fife Council (2nd ed 1997) *Sustainability indicators for Fife: improving the quality of life and the quality of the environment in Fife* Glenrothes, Fife Council
- Freeman A M (1993) *The measurement of environmental and resource values: theory and methods* Washington DC, Resources for the Future
- Ghazi P (1998) "Vital statistics" *New Scientist* No.2128, 4 April, 18-19
- Giannias D, Liargovas P, Manolas G (1999) "Quality of life indicators for analysing convergence in the European Union" *Regional Studies*, 33(1), 27-35
- Golan E H, Adelman I, Vogel S (1999) "Environmental distortions and welfare consequences in a social accounting matrix framework" in Frisvold G & Kuhn B eds *Global environmental change and agriculture: assessing the impacts* Cheltenham, Edward Elgar
- Gray R, Bebbington J, Walters D (1993) *Accounting for the environment* London, Paul Chapman
- Grossman G M (1995) "Pollution and growth: what do we know?" in Goldin I & Winters L A eds *The economics of sustainable development* Cambridge, Cambridge University Press
- Guinomet I, Sensi A, Jesinghaus J, Parker J (1997) "Approaches to indicators of sustainable development in the European Commission", in Moldan et al, *op.cit.*
- Hajer M A (1996) "Ecological modernisation as cultural politics" in Lash S Szerszynski B, Wynne B eds *Risk, environment and modernity: towards a new ecology* London, Sage
- Hamilton K (1994) "Green adjustments to GDP", *Resource Policy*, **20**, 155-168
- Hamilton-Wentworth (1993) *Sustainable community decision-making guide* Ontario, Regional Municipality of Hamilton-Wentworth
- Hammond A, Adriaanse A, Rodenburg E, Bryant D, Woodward R (1995) *Environmental indicators: a systematic approach to measuring and reporting on environmental policy performance in the context of sustainable development* Washington D C, World Resources Institute
- Hartwick J M (1990) "Natural resources, national accounting and economic depreciation", *Journal of Public Economics* **43**, 291-304
- Hewitt N (1995) *European Local Agenda 21 Planning Guide: how to engage in long term environmental action planning towards sustainability* Freiburg, International Council for Local

## Environmental Initiatives

- Hocking R & Shaked P (1993) "Environmental performance quality: measurement and improvement" *Business Strategy and the Environment* 2(4), 19-24
- Holland L (1997) "The role of expert working parties in the successful design and implementation of sustainability indicators" *European Environment* 7(2), 39-45
- International Council for Local Environmental Initiatives (1996) *The Local Agenda 21 Planning Guide* Toronto, ICLEI
- International Institute for Sustainable Development (1997) *The Bellagio Principles*, Winnipeg, Manitoba. IISD
- Jackson AA & Roberts P (1997) "Greening the Fife economy: ecological modernisation as a pathway for local economic development" *Journal of Environmental Planning and Management* 40(5), 615-629
- Jackson AA (1998) "Determining the impact of discretionary development assistance: the Scottish Enterprise Output Measurement Framework" *Regional Studies* 32(6), 559-577
- Jackson AA & Roberts P (1999) "Ecological modernisation as a model for regional development: the changing nature and context of the Eastern Scotland Structural Fund Programme" *Journal of Environmental Policy and Planning* 1 (1), 61-75.
- Jackson T & Marks N (1994) *Measuring sustainable economic welfare: a pilot index for the UK 1950-1990* London, Stockholm Environment Institute/New Economics Foundation
- Jackson T, Laing F, MacGillivray A, Marks N, Ralls J, Styme S (1997) *An index of sustainable economic welfare for the UK, 1950-1996* Surrey, Centre for Environmental Strategy, University of Surrey
- James P & Wehrmeyer W (1996) "Environmental performance measurement" in Groenewegen P, Fischer K, Jenkins E G, Schot J eds *The greening of industry resource guide and bibliography* Washington D C, Island Press
- Jeffcote M (1997) "Sustainable development indicators - who needs them?" *Local Environment News* 3(10), 9-11
- Lancashire County Planning Department (1997) *Lancashire's Green Audit 2: a sustainability report - Lancashire's key environmental, social and economic indicators, their inter-relationships and trends* Preston, Lancashire County Council
- Levett R (1996) "Linking the indicators" *Town and Country Planning* 65(12), 327-330
- Levett R (1999) "Baker's dozen needs leavening of wisdom" *Town and Country Planning* 68(1), 2-3
- Linster M (1997) "OECD environmental indicators", in Moldan et al, *op.cit.*
- McCleery A, MacDonald CC, Peat JA, Walker CA (1987) *Economic and social change in the*

MacDonald M (1998) *Agendas for sustainability: environment and development into the twenty-first century* London, Routledge

MacGillivray A ed (1994) *Environmental measures: indicators for the UK environment* London, Environment Challenge Group

MacGillivray A & Zadek S (1995) *Accounting for change: an essential guide to sustainable development indicators* London, New Economics Foundation

MacGillivray A (1997) "Social development indicators", in Moldan et al, *op.cit.*

Maclaren V W (1996) "Urban sustainability reporting" *Journal of the American Planning Association* 62(2), 184-202

McLaughlin B P "Rural policy in the 1980s - the revival of the rural idyll" *Journal of Rural Studies*, 2, 81-90

Macnaughten P, Grove-White R, Jacobs M, Wynne B (1995) *Public perceptions and sustainability in Lancashire: indicators, institutions, participation* Preston, Lancashire County Council

Macnaughten P, Grove-White R, Jacobs M, Wynne B (1997) "Sustainability and indicators" in McDonagh P & Prothero A eds, McDonagh P & Prothero A eds (1997) *Green management: a reader* London, The Dryden Press

McKinley T (1997) "Linking sustainability to human deprivation", in Moldan et al, *op.cit.*

Maeler K-G (1991) "National accounts and environmental resources", *Environmental and Resource Economics* 1, 1-15

Mayo E, MacGillivray A, McLaren D (1997) "The Index of Sustainable Economic Welfare for the United Kingdom" in Moldan et al, *op.cit.*

Midwinter A & Monaghan C (1990) *The measurement and analysis of rural disadvantage* Edinburgh, COSLA

Moffat I, Hanley N, Gill J F (1994) "Measuring and assessing indicators of sustainable development for Scotland: a pilot survey" *International Journal of Sustainable Development and World Ecology*, 1, 170-177

Moffat I & Wilson M D (1994) "An index of sustainable economic welfare for Scotland 1980-91" *International Journal of Sustainable Development and World Ecology*, 1, 264-291

Moldan B, Billharz S, Matravers R eds (1997) *Sustainability indicators: report on project on indicators of sustainable development* Chichester, John Wiley

Moldan B (1997) "The UNDP Human development Index", in Moldan et al, *op.cit.*

- Morrey C (1997) "Indicators of sustainable development in the UK", in Moldan et al, *op.cit.*
- Morrey C & Hillier H (1996) "How on earth do we measure sustainable development?" *Statistical News*, 112, 3-12
- Mortensen L F (1997) "The driving force-state-response framework used by CSD" in Moldan et al, *op.cit.*
- Neumayer E (1999) *Weak versus strong sustainability: exploring the limits of two opposing paradigms* Cheltenham, Edward Elgar
- Nordhaus W & Tobin J (1972) "Is growth obsolete?" in National Bureau of Economic Research, eds, *Economic growth, fiftieth anniversary colloquium* New York, Columbia University
- Organisation for Economic Co-operation and Development (1993) *Indicators for the integration of environmental concerns into transport policies* Paris, OECD
- Organisation for Economic Co-operation and Development (1994) *Environmental indicators* Paris, OECD
- Organisation for Economic Co-operation and Development (1998) *Towards sustainable development: environmental indicators* Paris, OECD
- Pearce D, Markandya A, Barbier E B (1989) *Blueprint for a green economy* London, Earthscan
- Pearce D W & Atkinson G (1993) "Capital theory and the measurement of sustainable development: an indicator of weak sustainability", *Ecological Economics*, 8, 103-108
- Perman R, Ma Y, McGilvray J (1996) *Natural resource and environmental economics* Harlow, Longman
- Pinfield G (1997) "Sustainability indicators: a new too for evaluation?" in Farthing S M ed *Evaluation of local environmental policy* Aldershot, Avebury
- Regional Development Agency (1999) *RDA evaluation and monitoring framework* (mimeo)
- Roberts P (1995) *Environmentally sustainable business: a local and regional perspective* London, Paul Chapman
- Rowan L (1995) *Sustainability indicators project study report* Glenrothes, Fife Regional Council
- Royal Society for the Protection of Birds (1994) *Environmental measures - indicators for the UK environment* Sandy Berks, RSPB, WWF and New Economics Foundation
- Scottish Enterprise (1998) *The network strategy*, Glasgow, Scottish Enterprise Network
- Scottish Enterprise (1999a) *Baselines, benchmarks and milestones for the Scottish economy*, Glasgow, Scottish Enterprise Network

- Scottish Enterprise (1999b) *Guidelines for sustainable development appraisal*, Glasgow, Scottish Enterprise Network
- Scottish Enterprise (1999c) *Measuring Scottish Enterprise's contribution to the achievement of the new strategy*, Glasgow, Scottish Enterprise Network
- Scottish Environment Forum (1997) *Poverty and sustainable development in Scotland: meeting the challenge of implementing Chapter 3 of Agenda 21* Edinburgh, SEF
- Selman P (1996) *Local sustainability: managing and planning ecologically sound places* London, Paul Chapman
- Shucksmith M, Chapman P, Clark GM, Black S, Conway E (1994) *Disadvantage in rural Scotland: how is it experienced and how can it be tackled?* Aberdeen, Rural Forum for Scotland/University of Aberdeen
- Shucksmith M, Chapman P, Clark GM (1996) *Rural Scotland today: the best of both worlds?* Aldershot, Avebury
- Strathclyde Regional Council (1995) *Strathclyde sustainability indicators* Glasgow, SRC
- Sustainable Development Team (1999) *Down to earth: a Scottish perspective on sustainable development* Edinburgh, Scottish Office
- Touche Ross (1994) *Sustainability indicators research project: report of Phase 1* Luton. Local Government Management Board
- Touche Ross (1995) *Sustainability indicators research project: consultants; report of the Pilot Phase* Luton, Local Government Management Board
- United Nations Inter-Secretariat Working Group in National Accounts (1993) *System of National Accounts* New York, United Nations
- United Nations (1993) *Integrated environmental and economic accounting* Series F, No.61, New York, United Nations
- United Nations (1996) *Indicators of sustainable development: framework and methodologies* New York, United Nations
- Walter G R & Wilkerson O (1998) "Community sustainability auditing" *Journal of Environmental Planning and Management* 41(6), 673-691
- Welford R (1993) "Breaking the link between quality and the environment: auditing for sustainability and life-cycle assessment" *Business Strategy and the Environment* 4(1), 25-33
- Welford R (1995) *Environmental strategy and sustainable development: the corporate challenge for the twenty-first century* London, Routledge
- Welford R (1997) *Hijacking environmentalism: corporate responses to sustainable development*

London, Earthscan

World Bank (1992) *Development and the environment: World Development Report 1992* Oxford, Oxford University Press

World Bank (1997) *Expanding the measure of wealth: indicators of environmentally sustainable development*, Washington DC, World Bank (available at <http://www-esd.worldbank.org/eei/wealth/genuinesav.html>)

World Commission on Environment and Development (1987) *Our common future* Oxford, Oxford University Press

World Conservation Union, United Nations Environment Programme, Worldwide Fund for Nature (1991) *Caring for the environment* Gland, WCU

W S Atkins (1998) *Development of an overall indicator of air pollution concentrations: final report* Epsom, W S Atkins

Zimmerman W F (1997) "Towards evaluating social and institutional sustainability", in Moldan et al, *op.cit.*