Available online at www.elixirpublishers.com (Elixir International Journal)

Social Science

Elixir Soc. Sci. 47 (2012) 8741-8751

ISSN: 2229-712X

Concepts, approach and indicators for sustainable regional development

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ARTICLE INFO

Article history:

Received: 14 March 2012;

Received in revised form:

18 May 2012;

Accepted: 5 June 2012;

Keywords

Sustainable development,
Sustainable regional development,
Indicators for sustainable regional development.

ABSTRACT

This paper addresses the concepts of sustainable development, sustainable regional development and constitutes for an indicators for sustainable development. The notion of sustainable development has a fundamental nature, and serves as the basis for other new and innovative concepts and principles arising within environmental conventions. Sustainable development (SD) is development that lasts for long time. This paper has two parts. Firstly, the idea of sustainable regional development (SRD) refers to the integration of sustainable development principles into regional development practice. Secondly, indicators are today seen as having an increasingly important role in sustainable development or sustainable regional development and can provide crucial guidance for decision- making in a variety of ways. This study uses for traditional data sources and measures as a basis for SD and SRD indicators. The aim of this study is to analyze the indicators for sustainable development and sustainable regional development. This paper finds that it is a qualitative policy concept, which needs a quantitative operationalization. It is hoped that this paper will make a significant contribution to the realisation of sustainable regional development.

Introduction

The most widely accepted definition of sustainable development is that given by the World Commission on Environment and Development (the Brundtland Commission) in 1987: …development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED, 1987).

This definition implies that development is sustainable if it enables future generations to enjoy a level of well-being that is at least as high as that of the current generation. It therefore incorporates a strong direction towards inter-generational equity. The concept of 'needs' is emphasised, implying that the basic needs of the world's poor both now and in the future should be given priority. It also incorporates a sense of the limitations on the environment to meet those needs. Finally, the definition reflects the dynamism of the concept, in other words, the idea that sustainable development is an evolving state that allows for change as long as it is balanced. Indeed, a key aspect of sustainable development is the idea of the 'whole' system that can co-evolve successfully in a changing environment. This recognises that there are linkages and interactions across the system and that these need to be managed to provide a balanced or sustainable outcome.

The Brundtland definition of sustainable development is sufficiently broad to encapsulate economic, environmental and social concerns. The addition of social concerns to the concept of sustainable development is relatively new, with the Brundtland Commission being one of the first to adopt this broader, more holistic approach. However, while most observers acknowledge the appropriateness of social concerns to sustainable development in a conceptual sense, social indicators continue to pose a challenge, given the very wide range of issues with which they are concerned. Of those that are relatively easy to measure (for example, employment), many are used as economic rather than social indicators. This has resulted in the relative under-development of social indicators compared to economic and environmental ones, although in Ireland work in the latter area is also relatively recent.

The concept of sustainable regional development (SRD) refers to the integration of sustainable development principles into regional development practice. Accordingly, SRD encompasses all activities and instruments that promote sustainable development within regional economic initiatives. This focus is justified firstly by the important role of regions as intermediaries between national and local levels, and secondly by the growing consensus that sustainability is an essential criterion within future regional development.

In addition to matching policy trends at EU and national levels, each of which is moving towards much more integrated forms of operation, SRD aims to act as a catalyst in raising awareness amongst regional development professionals. It illustrates that there is no longer scope to concentrate only on economic growth, and this broader perspective encompasses activities ranging from establishing new forms of partnership to exploring innovative planning and integration methodologies.

Although it represents a relatively new field, substantial knowledge and expertise in SRD already exist, and it has advanced sufficiently in theory and practice to become recognised as a specialist field with an emerging body of literature, as well as associated intellectual dilemmas and problems of realisation (ENSURE, 2000).

The Commission, Eurostat and the research community are investigating the feasibility of these 'best needed indicators'. Eurostat reports on progress in ensuring the availability of the 'best needed indicators' which are feasible. Indicators under development according to Eurostat's contribution to the 2007 (and most recent) Commission report on the progress on the SDS included: a 'Genuine Savings' indicator, an 'eco-innovation' indicator, an indicator to measure 'Green Public

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Procurement and an indicator for 'Total Material Consumption' (CEC 2007).

Economic Performance and Social Progress which was created at the beginning of 2008 on the initiative of the French government. The scope of the initiative is global and aims to: identify the limits of GDP as an indicator of economic performance and social progress; consider what additional information is required to produce a more relevant picture; discuss how to present this information in the most appropriate way; and assess the feasibility of measurement tools proposed by the Commission (CMEPSP 2009).

The assessment of environmental trends at EU and Member State level is based on the use of indicators. For the most recent Environment Policy Review (EPR), covering 2008, 30 indicators were used to assess the environmental trends across the EU 27. These covered the key environmental issues and were divided into the following themes: climate change and energy; nature and biodiversity; environment and health; natural resources and waste; environment and economy; and implementation (CEC 2009).

The range of social indicators is very broad and includes many measures that the OECD has developed over the years. Social indicators provide objective measures of the conditions in which people live, the factors shaping these conditions and the actions taken by governments to preserve and improve them. OECD social indicators are grouped under four broad policy objectives: enhancing the self-sufficiency of individuals, promoting equity in social outcomes, improving the health of populations, and securing social cohesion (OECDa, 2005).

Progressing towards sustainable development implies that the objectives of increasing economic efficiency and material wealth must take into account social and environmental objectives. Explicit in the concept is a focus on inter-generational equity, implying that future generations should have opportunities similar to those now available. Sustainable development also puts emphasis on equity that applies both across and within countries (OECDb, 2005).

Sustainable development

The concept of sustainable development has a fundamental nature, and serves as the basis for other new and innovative concepts and principles arising within environmental conventions. Sustainable development is development that lasts for long time. The Brundtland Commission (WCED, 1987) correctly defined sustainable development as, "meeting the needs of the present generation without compromising the ability of the future generations to meet their needs". At present and in future, sustainability is related to the economic, social and environmental systems that make up the community provide a healthy, productive and meaningful life for all community residents.

Pillars of Sustainable Development

At present and in future, sustainability is related to the economic, social and environmental systems that make up the community provide a healthy, productive and meaningful life for all community residents (Figure 2).

The path to sustainable is a threefold process. Sustainable development has three aspects: economic, social and environmental, which are linked together and have overlapping within themselves. So, the three parts and their links are to understanding sustainable development, because sustainable development is about more than quality of life and achieving balance among the social, economic and environmental price of a community.

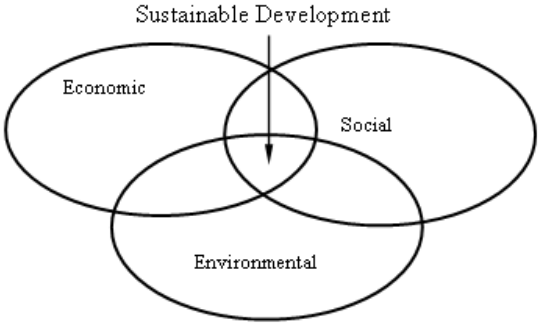

Figure 1: Sustainable development

Source: WCED, 1987

Indicators for Sustainable Development

Indicators can provide crucial guidance for decision-making in a variety of ways. They can translate physical and social science knowledge into manageable units of information that can facilitate the decision- making process. They can help to measure and calibrate progress towards sustainable development goals. They can provide an early warning, sounding the alarm in time to prevent economic, social and environmental damage. They are also important tools to communicate ideas, thoughts and values.

There are many tools and methodologies designed to measure and communicate progress towards SD. One of the most popular tools is indicators and indices, an index being an amalgam of more than one indicator. A sustainable development indicator (SDI) can generally be understood as a quantitative tool that analyses changes, while measuring and communicating progress towards the sustainable use and management of economic, social, institutional and environmental resources. An indicator is something that points to an issue or condition. Its purpose is to show how well a system is working towards the defined goals. An indicator can also be used in an evaluation, assessing if a development project takes into consideration aspects of SD. Indicators are normally seen as something quantifiable and in that sense an indicator is not the same thing as an indication. This does not mean that there can be no qualitative indicators. The choice between quantitative and qualitative indicators depends mainly on the purpose of the indicators, though quantifiable indicators are more frequently used (Gallopin 1997).

Instead of having this "one-problem, one-indicator" approach, SDI should thus aim to develop a framework that tries to bring the economic, social and environmental aspects of society together, emphasising the links between them. Understanding the three parts and the linkages between them is thus the key to developing and using sustainable indicators. Sustainable indicators should therefore point to areas where the linkages between the economy, the environment and society are weakest. They should also reflect the fact that the economy, society and the environment are tightly interconnected. Four dimension of sustainable development indicators are discussed in the following:

Social Dimension

Equity: Social equity is one of the principal values underlying sustainable development, with people and their quality of life being recognized as a central issue. Equity involves the degree of fairness and inclusiveness with which resources are distributed, opportunities afforded, and decisions made. It

includes the provision of comparable opportunities of employment and social services, including education, health and justice. The notion can be relevant both within and between communities and nations. Significant issues related to the achievement of social equity include poverty alleviation; employment and income distribution; gender, ethnic and age inclusiveness, access to financial and natural resources; and intergenerational opportunity. Impoverished people may feel powerless and isolated, and face pervasive and systematic problems related to insecure livelihoods, malnutrition and poor health, illiteracy, civil insecurity linked to violence and strife, and corruption. The concentration of the rural poor on marginal land leads to resource over-exploitation and land degradation.

The indicators in the core set cover the issues of poverty, income inequality, unemployment, and gender equality. They represent priority issues for countries and the international community. The indicators are widely used, well- tested measures, associated with established goals and targets. The target of reducing the proportion of the population living in extreme poverty in developing countries by half by 2015 was accepted at the World Summit for Social Development. The Fourth World Conference on Women called for the elimination of discriminatory practices in employment. The general goal of full employment to enable men and women to attain secure and sustainable livelihoods was upheld at the World Summit for Social Development, while many countries have more specific national targets for unemployment.

Health: Health and sustainable development are closely connected. Safe water supply and sanitation, proper nutrition and a safe food supply, unpolluted living conditions, the control of disease, and access to health services all contribute to healthy populations. Conversely, poverty, lack of information and education, natural and human- induced disasters, and rapid urbanization can all exacerbate health problems. Pollution control and health protection services have often not kept pace with economic development. As a consequence, poor health is associated with decreased productivity, particularly in the labour- intensive agricultural sector.

Development cannot be achieved or sustained when a high proportion of the population is affected by poor health and inadequate access to health care facilities. While economic growth and development can contribute to improved health and better health care facilities in the poorest countries, there are also high and middle-income countries where further improvements are warranted. A clean environment is important to citizens' health and well-being. Unsustainable economic growth can also cause environmental degradation which, together with inappropriate consumption, can adversely influence human health.

Education: Education, as a lifelong process, is widely accepted as a fundamental prerequisite for the achievement of sustainable development. It cuts across all areas of Agenda 21, being a particularly critical element in meeting basic human needs, and in achieving equity, capacity building, access to information, and strengthening science (United Nations, 1996). Education is also recognized as a means of changing consumption and production patterns to a more sustainable path.

Education, both formal and informal, is regarded as a process by which human beings and societies can reach their full potential. There is a close association between the general level of education attained and the persistence of poverty irrespective of the level of a country's development. It is vital to changing people's attitudes to achieve ethical awareness, values, attitudes, skills, and behaviour consistent with the goal of building a more sustainable society. In this way, people are better equipped to participate in decision-making that adequately and successfully addresses environment and development issues.

Housing: Adequate shelter is one of the essential components of sustainable development. The availability of adequate shelter substantially contributes to safer, more equitable, productive, and healthier settlements. Living conditions, especially in urban areas, are influenced by excessive population concentration, inadequate planning and financial resources, and unemployment. Rural-urban migration exacerbates this situation contributing to the development of slums and informal settlements. Poor living conditions are associated with poverty, homelessness, poor health, social exclusion, family instability and insecurity, violence, environmental degradation, and increased vulnerability to disasters (United Nations, 1996).

Security: Crime prevention and criminal justice are an integral part of the development process. Civil society, good governance, and democracy rest on the promotion of justice as an essential condition for social stability, security, peace, human rights, and long-term sustainable development (United Nations, 1997). Such a stable and secure climate is necessary to support the goals of poverty eradication, economic investment, environmental stewardship, gender equality, participation, and sustainable livelihoods. Security represents a new dimension in the revised framework for CSD indicators. This recognition reflects the growing priority given to security, including crime prevention, within the context of sustainable development in recent years.

Population: Population provides an important contextual reference on sustainable development for decision makers looking at the interrelationships between people, resources, the environment and development. Population change is a significant signal as countries try to reduce poverty, achieve economic progress, improve environmental protection, and move to more sustainable consumption and production. More stable levels of fertility can have a considerable positive impact on quality of life. In many countries, slower population growth has bought more time to adjust to future population increases.

Economic Dimension

Economic Structure: Trade and investment are important factors in economic growth and sustainable development. Improved access to markets, transfer of financial resources and technology, and debt relief are critical to assisting developing countries meet the objectives of sustainable development. Poverty, natural resource exploitation, and consumption and production are all intimately connected to economic growth or the lack of it. It represents a considerable challenge to ensure that economic growth leads to social equity and does not contribute to environmental degradation

Consumption and Production Patterns: Unsustainable patterns of consumption and production, particularly in developed countries, are the major cause of the continued depletion of natural resources and deterioration of the global environment (United Nations, 1997). It is widely acknowledged that the Earth cannot support the consumption levels of industrialized countries on a global scale. In addition, such high levels of consumption affect the current and future consumption and production options of developing countries.

Environmental Dimension

Atmosphere: Priority atmospheric issues include climate change, stratospheric ozone depletion, acidification, eutrophication, urban air quality, and tropospheric ozone levels. The impacts of these issues relate to human health, biodiversity and the health of ecosystems, and economic damage. Many of the effects are long-term, global in nature, and irreversible with consequences for future generations.

Land: Land consists not only of the physical space and the surface topography, but includes the associated natural resources of soil, mineral deposits, water, and plant and animal communities. Use of the land in an unsustainable way affects these resources, as well as the atmosphere and marine ecosystems. Land is becoming an increasingly scarce resource, particularly quality land for primary production of biomass and for conservation, due to expanding human requirements. The magnitude of land use and land cover changes threatens the stability and resilience of ecosystems through, for example, global warming and disruption of the global nitrogen cycle (United Nations, 2000).

Ocean, sea and coasts: Occupying about 70% of the earth's surface, oceans and seas represent highly productive ecosystems that continuously recycle chemicals, nutrients, and water. This recycling regulates weather and climate, including global temperature. In addition, marine, estuary and coastal ecosystems (such as coral reefs, wetlands, and mangrove forests) are significant to biodiversity and support valuable natural resources. It is estimated, for example that 90% of the world's fish production is dependent on coastal areas at some point in its life cycle.

Coastal zones, at the interface of land and water, occupy less than 15% of the earth's surface; yet accommodate over 2 billion people, more than one-third of the world's population. This population primarily lives in large cities frequently cited in association with key ecosystems such as river estuaries. The proportion of people living in the coastal zone (within 100 kilometers of the shore) is estimated to be approximately 37% of the global population and is expected to grow substantially by the year 2020 (United Nations, 1999).

Freshwater: Freshwater is essential to support human life, ecosystems, and economic development. It supports domestic water supplies, food production, fisheries, industry, hydropower generation, navigation, and recreation. The ecosystem services of freshwater systems include food production, reduction of flood risk, and the filtering of pollutants. The global issues of health, poverty, climate change, deforestation, desertification, and land use change are all directly associated with the water resource and its management.

Biodiversity: Biological diversity consists not only of variety among species, but also genetic variation within species, and variation between communities of species, habitats and ecosystems. This biodiversity of genes, species, and ecosystems contributes essential products and services to human welfare. Maintaining biodiversity helps ensure that the Earth will continue to perform natural ecological processes upon which all life depends. Major changes, loss, or degradation of biodiversity can result in serious economic, social, and cultural impacts; and have profound ecological and ethical implications. More than 40% of the world's economy and about 80% of the needs of the world's poor are dependent upon biological diversity (United Nations, 1997). Food security, climatic stability, freshwater security and human health needs are all directly associated with the maintenance and use of biodiversity.

Institutional Dimension

Institutional Framework: Appropriate legal and policy instruments are required as an institutional framework to encourage and implement sustainable development. The integration of social, economic, and environmental factors is a particular important feature of such instruments. Implementation of sound sustainable development strategies and international treaties by countries should contribute to improved socioeconomic and environmental conditions, and help reduce potential sources of conflict between countries.

Institutional Capacity : The ability of a country to progress towards sustainable development is largely determined by the capacity of its people and institutions (United Nations, 1997). Capacity can be measured by a country's human, scientific, technological, organizational, institutional, and resource capabilities. Institutional capacity enhances participatory planning, implementation, and monitoring related to sustainable development. An increase in capacity improves community skills and abilities to address crucial questions, evaluate policy options and implementation approaches, and appreciate constraints and limitations.

Sustainable regional development

The rising popularity of the notion of sustainable development has increasingly provoked the need for an operational (i.e., practical, measurable and policyrelevant) description or definition of this concept. The standard, widely-cited WCED definition of sustainable development as "a development that fulfils the needs of the present generation without endangering the future needs of future generations" is a meaningful starting point, but fails to offer manageable guidelines for sustainability strategies of (local, regional, national or international) decision-making bodies or other actors. The complementary description of sustainable development by the IUCN/UNEP/WNF emphasises from a more ecological angle the need for "improving the quality of human life while living within the carrying capacity of supporting ecosystems".

Since the beginning of the world-wide debate on sustainable development, a massive volume of literature has been published on this notion. So far, no uniformly accepted definition has been offered, although the basic intentions of the sustainability concept are clear: it aims at directing decisions of policy bodies and private actors towards a joint state of the economy (or society at large) and the ecology, such that the needs of current and future generations are fulfilled without eroding the ecological basis for a proper welfare and activity level of these generations.

A major issue in sustainability policy is the question how sustainability can be identified as a normative orientation for policy. In this context, sometimes reference is made to the need to maintain natural (or environmental) capital (see e.g. Pearce and Turner 1990). In other cases, the need to ensure an uninterrupted flow of revenues from a given capital stock in a foreseeable time horizon is emphasized. Notions of sustainability and irreversibility are at stake here (see Georgescu-Roegen 1971 and Ayres 1978). The concepts of weak and strong sustainability are also used to clarify some of the complex trade-off issues involved.

In general, it seems feasible to operationalize regional sustainability by specifying a set of minimum (or critical) conditions to be fulfilled in any development initiative for a

region. These conditions may relate to economic, social and environmental objectives (see Pearce et al. 1988). Such critical conditions are usually not specified via one single indicator, but require multiple criteria. As a consequence, multiple criteria analysis may be seen as a helpful operational instrument for regional sustainable development policy. Application of this analysis framework may also be meaningful in the context of the precautionary principle advocated by Perrings (1991). Consequently, it seems a practical approach to describe environmental considerations and concerns mainly in terms of reference values or threshold conditions (limits, standards, norms) on resource use and environmental degradation (or pollution). This is in agreement with popular notions like carrying capacity, maximum yield, critical loads, environmental utilization space, maximum environmental capacity use and so forth. It has - despite a variety in approaches - increasingly become clear that sustainable development is a normative development concept. We will in this article adhere to this approach by using the notion of a critical threshold value as a normative form of reference in a multiple criteria modelling context.

The issue of regional sustainable development has been considered under the three broad headings of economic, social and ecological concerns in a demarcated geographical area (Van den Bergh 1996). The economic aspects are related to income, production, investments, market developments, price formation etc. The social concerns refer to distributional and equity considerations, such as income distribution, access to markets, wealth and power positions of certain groups or regions etc. And the environmental dimensions are concerned with quality of life, resource scarcity, pollution and related variables. It is clear that that the above mentioned three classes of variables are strongly interlinked, but they are to a certain extent also mutually conflicting. Putting more emphasis on a higher availability of the one category tends to reduce the availability or usability of either of the other ones. This may in a stylized way be depicted by means of the following mobius triangle (Figure 1).

Two observations are in order in relation to Figure 1. The three force fields are essentially latent variables which have to be measured (or approximated) by means of manifest, observable indicators. And secondly, the actual state of (un)sustainable development is never static in nature, but always in a state of flux (Norgaard 1994). Consequently, there is a need for monitoring actual development over time and for identifying changing conflicts of interest between actors.

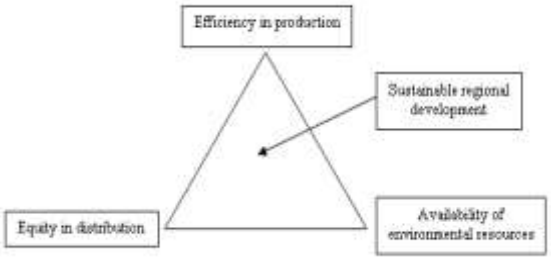

Figure 2: Mobius triangle illustrating mutual dependence of policy goals

In general, it would be desirable to construct a comprehensive impact model which would encapsulate the complex interacting patterns of regional development and related land use in relation to social and environmental variables. Such a modelling activity could take the form of either an econometric model (validated by empirical data on solid statistical grounds) or a simulation model (calibrated at best by plausible information). In light of the near-impossibility to construct for each individual regional development plan or project a dedicated model, in practice one often resorts to an ad hoc impact assessment, based on simple cause-effect relationships. Such a more limited approach has obviously several shortcomings, but has the advantage that it is manageable, practical and based on local expertise. In such a case, foreseeable consequences of various types of human or government intervention can be assessed by a combination of ad hoc surveys, comparative studies, simple correlation techniques, local experts' views and Delphi methods. The uncertainties involved may then be gauged by exercising a systematic sensitivity analysis in a broad range of uncertainty intervals around the information used.

Indicators of Sustainable Regional Development

The judgement of a regional development process requires a set of relevant sustainability indicators. In a recent paper by Boisvert et al. (1996), the following considerations were formulated for the identification of practical sustainability indicators: they should be representative for the structure and dynamic behaviour of the system concerned they should be constructed on a spatial and temporal scale that is relevant to natural, economic and social phenomena they should be presented in a format suitable to decision-making, i.e. quantifiable, legible and transparent:

- they should include distributional dimensions
- they should specify threshold values in a normative policy context
- they should be able to be used in forecasting.

It is clear that there is not an unambiguous set of environmentally sustainable development indicators, although the pressure-state-response (PSR) model developed by OECD (1993) offers an interesting operational framework.

The methodology to be developed here aims to offer a broad framework for decision support for regional sustainable development and may be useful for a wide array of applications, such as soil conservation, development of agro-industry, forest management, irrigation, watershed management, pesticides use, changes in vegetation, alternative harvest methods and so forth. For all such issues the idea is to offer a widely applicable framework for sustainable development planning, based on a systematic scoping and monitoring of sustainability opportunities and strategies. Clearly, this requires an identification of various classes of relevant indicators. Examples of environmental indicators are:

- impacts on ecosystems
- impacts on water quality and quantity
- effects on climate change and atmosphere
- use of (renewable and non-renewable) resources
- generation and disposal of waste
- changes in land use and landscape
- visual intrusion
- impacts on human health.

Such a set of classes of indicators is however not exhaustive; the ultimate choice of relevant indicators depends on the general policy field under investigation and on the specific policy issues and strategies to be envisaged (e.g., new cultivation methods, use of herbicides or pesticides, change in land ownership, changes in animal husbandry, changes in the natural resource base, new quota systems for fishery etc.).

By assessing all relevant effects, a data base has to be created which may serve to judge whether a certain regional development is sustainable or not, whether policies have been more or less successful, and whether new initiatives support sustainable development of the area. This requires in all cases some sort of an impact assessment (either ex post or ex ante), which means that the status quo (the initial conditions), the extent and type of intervention (e.g., policy), and the resulting state have to be assessed.

In order to assess the level of economic welfare, we usually look at GNP per capita. This is a macro-economic tool which measures production and economic growth in an aggregate and quantitative way. In principle, this measure can be further subdivided into regional or sectoral measures (including the social distribution of GNP). But average GNP does not seem to be helpful in measuring sustainable development. In this respect, the Human Development Index (HDI) advocated by UNDP (1990) seems to offer more opportunities as an alternative indicator for development, as it incorporates both social and economic indicators. This approach is based on the assumption that human development is the process of enlarging people's choices, where the most basic rights are concerned with healthy life, education and a decent standard of living. Nevertheless, it is still difficult to include also many environmental aspects. For social and environmental values such composite indicators are even more difficult to define. In general, an indicator is a partial, representative and quantitative mapping of a compound phenomenon into a one dimensional measure which is relevant for decision-making. Such indicators have to fulfil normally the following conditions:

- scientific basis
- measurability
- predictability
- user - and policy-relevant
- flexible space-time aggregation scale
- monitoring capability
- compatibility with available information bases.

Only under such conditions may we expect indicators to represent a high quality and reliability, a high policy relevance and a user manageability. It is clear that in all cases policy-relevant indicators should be concerned with both socio-economic and environmental aspects of agricultural development. Examples of elements of a socioeconomic profile in the agricultural sector are:

- income per capita
- skewness of income distribution
- unemployment level
- average duration of unemployment
- investments
- growth in production
- access to and use of technological knowledge and equipment
- training and eductional level
- demographic structure and growth
- cultural inertia, and so forth.

As will be suggested later on, these indicators can be subdivided into efficiencyoriented and equity-oriented indicators. Examples of environmental indicators are:

- health condition
- quality of and access to health care systems
- longevity
- infant mortality
- food supply
- nutrition level
- air pollution
- soil pollution
- noise
- landscape deterioration
- general natural resource condition
- top soil quality
- pollution abatement technologies
- distribution of pollution over various social classes or regions, and so forth.

Environmental externalities can also be subdivided into emissions of pollutants, and ambient concentrations in various areas, a distinction which runs parallel to efficiency and equity as level and distribution indicators. Finally, we may also separately include pollution abatement technologies for each relevant area or time period.

Sustainable development measurement

As we have already noted, the definition of sustainable development fundamentally depends upon in which context it is being used, and not least by who is defining it. The creation of SD indicators is something essentially delicate. Nevertheless, a number of tools and methodologies have been designed to help gauge progress towards SD, but given the disparity of views already described here there is no textbook providing a methodology that is generally accepted and applicable across regions (Mitchell, 1996).

The UN list of indicators arising out of the Rio conference is perhaps the most prominent example. In 1995 the UN Commission on Sustainable Development (CSD) adopted a Work Programme on indicators and related methodology (UNCSD, 1996). 59 indicators and methodology sheets are available today. In the EU system, Eurostat and the European Environment Agency (EEA) have used these 59 UN indicators as the basis for the EU SDI list of 63 indicators (Directorate-General for the Environment, 2000, European Commission, 2001).

Sustainable Regional Development Measurement

Regions are today seen as having an increasingly important role in sustainable development. This focus is justified firstly by the important role of regions as intermediaries between the national and local levels and secondly by the growing consensus that SD is an essential criterion within future regional development (Clement et al, 2003).

Although sustainable regional development (SRD) represents a relatively new field, substantial knowledge and expertise in SRD already exists within an emerging body of literature (EC, 1998, ENSURE, 2000, Schleicher-Tappeser et al, 1999). In parallel with the EU activity in this field, the theoretical and practical development of SRD has been supported by a series of multidisciplinary conferences and international workshops as well as by the creation of European networks for sustainable regional development (Clement et al, 2003). The process has pointed at the differentiated experience between countries and regions. In the case studies of SRD projects referred to by Clement et al, it has been found that the greater commonalities correspond to the difficulties encountered, whereas the more positive characteristics are differentiated between projects. One major common difficulty was the time and energy spent on persuading others of the value of such an SD approach as well as on agreeing upon a common understanding of SRD.

Despite the difficulties experienced in coming to a common understanding of SRD in the numerous case studies undertaken, the integration of SD into the evaluation criteria of development projects funded by the Structural Funds has been a big step towards attaining a communal methodology. The key document attempting to rationalise SRD is the EU Thematic Evaluation on the Contribution of the EU Structural Funds to Sustainable Development (EC, 2002). This report provides tools and methodologies to assist regions, Member States and the EU in assessing the sustainability of development plans and enhancing the sustainability of Structural Funds programmes in the 2000-2006 period. It is also intended to act as a guide in the preparation of Structural Funds policies beyond 2006. As we discussed in section two, the conceptualisation of SD as three pillars (the economy, society and the environment) can be translated into four types of capital. The EU system uses 'the four capital approach' to develop a discussion on the trade-offs between them. The report contains a sustainability assessment matrix specifying criteria against which to evaluate policies, programmes or projects. Finally, a project pipeline checklist provides questions for programme managers and monitoring committees designed to generate projects that contribute more efficiently to SD.

Accounting for Sustainable Development

Indicators for SD are useful for different reasons in different places. For a healthy, vibrant community, indicators may help ensure that negative trends are halted and dealt with before they become a severe problem. For communities with economic, social, or environmental problems, indicators can point the way to a better future. In all communities or regions, indicators can generate discussion among different people and stakeholders and help in a process of defining a shared vision of the future of the community. Indicators can be used for different purposes; three categories relevant for the regional level can be identified (Clement, 2001 and EC, 2002).

i) SDIs can be used to evaluate the SD of a region. The aim is to better understand the development process, and in particular the interaction between different dimensions of SD as well as following up on performance in relation to predefined targets. The baseline situation in the region has to be described quantitatively, and these indicators will later be instrumental for an *ex-post* evaluation of the impact of the SD programme.

ii) SDIs can be used as a help in deciding which specific regional development projects have the most potential to promote SD as well as supporting the evaluation of those projects funded. In the same way, indicators could serve as a tool for evaluating programmes such as the Structural Funds. Ideally, a list of indicators that are meaningful for project managers should be selected for the purpose of reporting. Evaluators will then use these indicators in their assessment of the degree of fulfilment of the goals of the programme.

iii) SDIs may also be used in order to attract attention to certain conditions or trends and in order to directly influence the behaviour of people.

These three purposes are not mutually exclusive, though many indicator initiatives have mainly one of these in focus. The chosen purpose determines the need for resources as well as the design and presentation of the indicators. In this paper we are concerned with indicators for the development of the region, i.e. the first category mentioned above.

To be able to define an efficient indicator system it is also essential to address not only the purpose of the indicator but also the question of to whom the indicator will be communicated. Is it experts, the general public, school children, the private sector, the media or a more specific target group? As to the use of SDIs in evaluating projects financed by the Structural Funds, it is the Monitoring Committee that decides upon the indicators (EC, 2002).

The first relates to how to define what an indicator should measure, the second relates to data collection and the third to the actual communication of indicators. The work with SDI in sustainable regional development is an ongoing project and even though some general practical guidelines have been defined for SRD (EC, 2002), "the how"-question is still very relevant to pose as the attempt to operationalise these guidelines has just begun.

The question of what constitutes a good indicator is by now well understood. The OECD (1994) established selection criteria for *environmental* indicators under three broad headings-policy relevance, analytical soundness, and measurability - but these criteria are broadly applicable to other indicators as well:

• Policy relevance:

− Indicators should be easy to interpret.

− They should show trends over time.

− They should be responsive to changes in underlying conditions.

− A threshold or reference value should be established, against which conditions can be measured.

• Analytical soundness:

− Indicators should be well-founded in technical and scientific terms.

• Measurability:

− Indicators should be calculated from data that are readily available or available at reasonable cost.

− Data should be documented and of known quality.

− Data and indicators should be updated at regular intervals.

Measurement of Indicator

Two different approaches may be discerned here. In the first approach the indicator measures the closeness to a defined target, with the aim to get the indicator to equal the target. In the second approach a direction for the indicator is defined, with the aim to get all or some of the indicators to move in the desired direction.

The first, i.e. using a defined target, is the most commonly used approach (Mitchell et al, 1995, Tschirley 1997 and Woodhouse 2000). This approach allows decision-makers to assess the gap or distance between the actual state and the desired reference condition. This desired reference condition could either be based on historical conditions, scientific data or for example the viewpoints of stakeholders. What level of deviation from the reference condition that should be considered acceptable could vary from zero to all sorts of compromises arising out of an essentially political process?

In the second approach, status is presented in relative terms. In this case, the motivation for change is to perform better over time or to perform better relative to other regions.

These two approaches to what an indicator should measure are closely linked to so-called conceptual frameworks for SDI (Bell and Morse 2003). Such frameworks facilitate the transformation of data into relevant information as they define what an indicator should measure and what the basis of the measurement should be. The most commonly used framework is the so-called driving force-pressure-state model (DPS). Driving forces are the demand for food, water and revenue, understood

as the causes of a certain effect. Pressure is understood as human activities designed to alter these driving forces. The state is the result or the difference between these driving forces and pressures. This approach provides indicators that mainly target policy-makers or decision-makers. Both the European Union (Eurostat and EEA) and the United Nations apply this framework as a basis for selecting their indicators on SD (European Commission, 2001 and UNCSD, 1996). Even though this approach is conceptually convenient and indeed popular, it does however exhibit a number of problems. One problem is that it reflects a sort of political end-of-pipe thinking that militates against more proactive responses encouraging short-term curative policies. Moreover, it has difficulty in capturing multiple causality and the interactions existing between indicators (Bell and Morse, 20003).

Another type of framework is the basic satisfaction framework. This framework rests on an analysis of what is deemed to be a basic necessity for SD as described by Bossel (1999). Indicators are selected on the basis of their ability to address a set of questions covering different aspects of sustainable development such as existence, effectiveness, security, adaptability and coexistence. The major problem with this framework is its apparent subjectivity and the fact that there is no immediate link between the indicator and the action. A version of this type of framework is used instead of comparing each indicator to some kind of general criteria in order to relate them to a defined set of goals (Meter, 1999). Such a matrix focuses on whether the indicators are linked to the issues that are important to a community or region. This type of matrix is useful for showing whether the indicator measures the goals of SD that are actually important for a particular community. The major difficulty with this system is that it makes comparisons between different communities difficult.

Constitutes of A good Indicator for Sustainable Development

The term indicator has a certain technical feel to it. It invokes numbers and statistics that are mainly used and understood by specialists and technocrats. It is certainly true that for SD indicators there has been, and still is, an emphasis on selecting indicators deemed to be relevant largely by applying a list of indicator rules defined by technicians (Bossel, 1999, Bell and Morse, 2003). Such lists of technical criteria are common in the SD literature and they stress for example that an indicator should be:

- **Specific:** Indicators must relate to the desired outcome, i.e. fit the purpose for measuring.
- **Measurable:** Indicators should preferably be open to measurement in a quantitative manner.
- **Pedagogical:** Indicators should be practical and designed for those who are going to use them.
- **Sensitive:** Indicators must readily change as circumstances change.
- **Reliable:** The information that an indicator is providing must be reliable. Data upon which the indicator is based must therefore be collected using a systematic method.
- **Based on accessible data:** In order to create good indicators it is important that the necessary information is available or can be gathered on a regular basis and while there is still time to act.
- **Cost-effective:** The cost of accumulating necessary data should not exceed the benefits of using the indicator.
- **Relevant and Usable:** Indicators should show what is needed to know. This includes the need for a clear definition of the objective that the indicators are meant to achieve. It also means that it is important to focus on those issues that a region, or a regional development project, can control or influence or that is of specific importance to the project.

Conclusion

Sustainable Development is a qualitative policy concept, which needs a quantitative operationalization. Sustainability is also a multidimensional concept, which requires a multidimensional evaluation technique. Finally, sustainability is to a significant extent a discrete concept (a situation is sustainable or not), which demands some type of discrete assessment method. In conclusion, it is hoped that this paper will make a significant contribution to the realisation of sustainable regional development.

The natural resource accounts mainly have an environmental and economic focus, particularly if the accounts are further developed. The accounts are generally successful in showing the inter relationships between the economy and the environment for specific natural resources

There are good reasons beyond the measurement of sustainability for extending national accounting systems. This argument is made forcefully by Nordhaus and Kokkelenberg (1999) in Nature's Numbers, the report to the US National Research Council on environmental accounting. But for many developing countries the combination of low saving effort, high resource depletion, high population growth, and ineffective public investments, particularly in education, means that the sustainability question is vital.

Understanding sustainable development linkages and achieving the required policy trade-offs across the environmental, economic and social spheres requires novel methodologies based on new types of statistical approaches. The challenge in measuring sustainable development lies in developing new indicators and combining these through accounting frameworks, decoupling methods, global approaches and composite indices. Solid analysis and measurement provide the basis for implementing sustainable development policies which accurately reflect the complexities of real world choices.

Regarding the integration of the social, economic, environmental, institutional and sustainable development dimensions, a low level of involvement by practitioners and poor people themselves in the economic and environmental issues is indicative of a low level of involvement in groundbreaking wealth generating trade relations in poverty eradication initiatives, hence the persistent poverty cycles. With reference to the less attention paid to the vulnerable groups, society relatively respond to people who have the ability to articulate their need for help as compared to the identified most vulnerable groups who lack such articulation skills.

Acknowledgements

Financial assistance provided by the research university Grant UKM-MI-OUP-2011 and UKM-AP-PLW-04-10. Institute for environment and development, University Kebangsaan Malaysia is gratefully acknowledged.

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2.2.1 Social Dimension

Theme	Sub-theme	Indicator
Equity	Poverty	Population living below poverty line
		Measures of income inequality
		Unemployment rate
		Youth unemployment rate
		Social benefits per capita
	Gender equality	Female to male wage ratio
	Child welfare	Child welfare
Health	Nutrition status	Nutritional status of population
	Illnesses	Mortality due to selected key illnesses
	Mortality	Infant mortality
		Life expectancy at birth
	Sanitation	Population connected to sanitation system
	Healthcare delivery	National health expenditure
		Immunisation against childhood diseases
Education	Educational level	Levels of educational attainment
	Literacy	Low qualification levels
Housing	Living conditions	Numbers of rooms per capita
		Household composition
Security	Crime	Reported crimes
Population	Population change	Population growth rate
		Population density
		Net migration rate

Source: Eurostat, 2004.

2.2.2 Economic Dimension

Theme	Sub-theme	Indicator
Economic structure	Economic performance	Per capita GDP
		Investment share in GDP
		Value added by main sector
		Inflation rate
	Trade	Net current account
		EU and international markets
	Financial status	Public debt
		Aid to developing countries
Consumption and production patterns	Material consumption	Material consumption
	Energy use	Per capita *g*ross inland energy consumption
		Renewable energy sources
		Intensity of energy use
	Waste generation and management	Generation and disposal of municipal waste
		Generation of industrial waste
		Generation and disposal of hazardous waste
		Generation and disposal of radioactive waste
		Recycling of waste: paper and glass
		Waste treatment and disposal facilities
	Transportation	Passenger transport by mode
		Freight transport by mode
	Environmental protection	Environmental protection expenditures

Source: Eurostat, 2004.

2.2.3 Environmental Dimension

Theme	Sub-theme	Indicator
Atmosphere	Climate change	Per capita emissions of greenhouse gases
	Ozone layer depletion	Consumption of ozone depleting substances
	Air quality	Air pollutants in urban areas
Land	Agriculture	Agricultural area and organic farming
		Nitrogen balances
		Use of agricultural pesticides
	Forests	Total forest area
		Wood harvesting ratio
	Urbanisation	Growth of built up area
Ocean, sea and coasts	Costal zone	Eutrophication of costs and marine waters
	Fisheries	Fish catches by selected over-exploited species
Fresh water	Water quantity	Intensity of water use
	Water quality	BOD concentrations in selected rivers
		Quality of bathing waters
Biodiversity	Ecosystem	Protected area as a % of total area
	Species	Number of threatened species

Source: Eurostat, 2004.

2.2.4 Institutional Dimension

Theme	Sub-theme	Indicator
Institutional framework	Strategic Implementation of SD	National Sustainable Development Strategy
	International Cooperation	Implementation of Ratified Global Agreements
Institutional capacity	Information access	Internet access
	Communication structure	Communication Infrastructure
	Science and technology	Expenditure on research and development
	Nature disaster preparedness and response	Risks to human and natural capital

Source: Eurostat, 2004.