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# MEASUREMENT AND ACHIEVEMENT OF SUSTAINABLE DEVELOPMENT

## SUMMARY FINAL REPORT

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## I. OBJECTIVES

- to develop an operational and practical definition of sustainable development relevant to (i) the European Union and (ii) the developing world;
- to set out the conditions for achieving sustainable development;
- to develop practical and usable indicators and measures of sustainable development;
- to develop policy guidelines for the achievement of sustainable development.

## II. METHODOLOGY

The methodology that the project used draws on a fundamentally economic approach. The research team recognise that this is by no means the only way to analyse sustainability but would argue that it has many virtues. Sustainability is a complex phenomena but too often attempts to offer a holistic treatment of the problem descend into analytical confusion. Whilst one must be wary of losing generality in aiming for simplicity, it is the economic approach that has so far been the most successful in analysing sustainability issues. One reason is that a clear line runs from theory and concepts through to the development of practical indicators.

Figure 1 illustrates this process. Starting with a definition of sustainability as non-declining human welfare (or well-being) over time, it is possible to trace the conditions for sustainability through to the measurement process that will inform us as to whether a region is meeting these conditions. In reality, meeting these conditions will not be sufficient to ensure sustainability. However, it does permit a first approximation. The data needed to develop these indicators are based on economic notions of monetary valuation: that is, individual willingness-to-pay for a unit of an environmental benefit. In other words, prices that form our indicators must represent marginal valuations. Physical indicators are essential as they provide the data upon which monetary valuation depends. In this way, information can be derived that allows a first judgement to be made about sustainability. Implicit in this is an assumption about the extent to which society is willing to trade off one component for another. This is contrary to the strong sustainability approach where some trade-offs are not permitted for a variety of reasons usually concerning the suspected uniqueness of environmental assets. The strong sustainability critique is a legitimate concern but in developing what has been called weak sustainability, this project has found that this approach can inform the debate far more than many have suspected. However, the team also endeavoured to link the two approaches towards sustainability.

Green accounting - e.g. better accounting for resources and environment - is at the heart of this approach. For example, at the micro-level the estimation of benefits of local natural assets and at the macro-level, green national accounting. At a time when green accounting is receiving so much attention from national accountants and decision-makers, this gives the approach an additional pertinence.

In a separate contract, three case studies of environmental valuation, that are consistent with the Contingent Valuation Method (CVM) approach to analysing sustainability issues were carried out in Central and Eastern Europe. These studies attempt to estimate the benefits of :

- preserving Bulgarian cultural monuments, in particular monasteries;
- traffic calming in Cracow, Poland;
- a cleanup programme in the Lake Balaton in Hungary

Hence, these studies assessed the scope for evaluating environmental damage, broadly defined, in transition economies. In doing so, one can draw practical lessons for implementing measures of progress toward sustainable development, in monetary terms, in these economies.

Figure 1. Measuring and Achieving Sustainability: project framework

Definition	Sustainable Development is: <i>non-declining human well-being</i>
Necessary Condition	<i>saving in order to keep (per capita) capital constant or rising over time</i>
Measurement	<i>economic valuation of natural capital: green accounting</i>
Policy	At the 'accounting level': <i>revise national accounts adopt savings rules indicators apply savings rule to corporations</i>  At the investment level: <i>- ensure projects and policies are appraised so that natural capital 'counts' - give consideration to sustainability constraints in project appraisal</i>  At the pricing level: <i>- ensure 'full cost' pricing is implemented - adopt economic instruments</i>

### III. MAIN RESULTS

#### The Need for Indicators of Sustainable Development

'Sustainable development' has become the catchphrase of the 1990s. Defining sustainable development is not too difficult: it is development or human well-being that lasts, i.e. does not decline. The difficulty lies in determining what has to be done to achieve it. Two conditions dominate this discussion.

- Weak sustainability (WS): this states that total (usually interpreted as) national wealth should not decrease over time. So long as adequate compensation is made in the form of saving and investment it does not matter if say, produced capital or human capital are substituted for natural assets.

- Strong sustainability (SS): this suggests a greater emphasis on the conservation of natural assets within the broader goal of prudently managing a (nation's) portfolio of assets over time. Specifically it is argued that some classes of natural assets have no substitutes and therefore cannot be replaced: i.e. critical natural assets.

Any policy regime addressing sustainable development must be capable of being monitored, if the successes or failures of policies are to be judged. Measures of both WS and SS will be required for this purpose. Ultimately, this means that data concerning the environment, the economy and society must be collected, analysed and made usable to policy-makers. Useful indicators are likely to be those that are linked to: (i) economic data; (ii) socio-economic impacts; (iii) a clear understanding of sustainable development. These points suggest that while physical indicators are an essential starting point, ultimately it is indicators based on economic notions of monetary valuation that are key to measuring sustainability. The research explored this proposition on a number of levels. The case studies have evaluated the environmental benefits derived from specific local natural assets (as say, an input into project appraisal). At the national level, the socio-economic impacts have been assessed- e.g. health - of pollution and showed how these can be integrated into green national accounting aggregates based on formal approaches. Lastly, the project has shown how sustainability can be measured at the international level. Implicit in much of this work is an assumption about the extent to which society is willing to trade off a particular asset for another. Hence, the approach leans towards the WS interpretation of sustainable development. Nevertheless, SS concerns can be introduced into this scheme where particular natural assets are thought to be unique. In addition, social aspects of the sustainability problem can be analysed.

### Green Net National Product

The results show that expanded measures of Net National Product (NNP) - 'green NNP' - should:

- deduct the value of resource depletion;
- add the value of growth of living resources;
- make no explicit adjustment for discoveries of sub-soil resources;
- deduct the value of pollution emissions;
- add the value of dissipation of pollutants in the environment
- include the value of household defensive expenditures made in order to mitigate the effects of environmental deterioration;
- expand these measures by adding the value that households place on the flow of environmental services. The outcome of this suggestion is better interpreted as a measure of economic welfare (MEW) rather than NNP *per se*.

The conceptual approach to green national accounting also gives clear guidance regarding the measurement of the relevant resource and environmental flows. Natural resources should be valued at their rental rate (international resource price minus costs of extraction), net of any emissions taxes associated with production (the existence of pollution externalities makes resources less valuable than they would otherwise be). Pollution flows should be valued at their marginal social costs.

However, measuring green NNP tells little about whether or an economy is on a sustainable path. To make this evaluation a different emphasis is required: the measurement of genuine savings.

### Genuine Savings

Genuine savings can be defined as the amount of saving over and above losses of assets including produced capital and natural assets (including resource depletion and damage caused by pollution emissions). Genuine savings is a one-sided indicator of weak sustainability and states that persistently negative genuine savings are not sustainable - i.e. well-being will eventually decline - and therefore must be corrected by policy.

The results indicate that countries do fail this test for sustainability (despite its focus on the allegedly 'non-stringent' weak sustainability) and hence, genuine savings add new information to the sustainability debate. For example, genuine savings in the United Kingdom were negative from 1980 to 1986.

The results also show the emerging issue of pollution related health impacts - e.g. of particulate matter - and the social costs of pollution in general, in green national accounting for regions such as Europe. Again, in the United Kingdom the per annum health costs from particulate matter (PM<sub>10</sub>) could be in region of 2% to 4.5% of GDP.

### International Trade

The extent to which weak sustainability or genuine savings rules must be adapted for international trade has two distinct aspects.

(1) With regard to transboundary pollution, wastes emitted in 'country A' contribute to asset loss in 'country B'. The social costs of these transported emissions should be deducted from the genuine savings (or green NNP) of country A - i.e. where the emissions originated - although the damage actually occurs in country B. This is an application of the polluter-pays-principle at the international level and can be interpreted as the hypothetical compensating income flows to be made if assets in the victim country are to be 'maintained intact'.

(2) For international trade in commercial natural resources, it is indeed the case that any country can - other things being equal - increase its genuine savings rate by importing its resource requirements (leaving domestic resources intact). Nevertheless, the direct question relating to sustainability is whether or not this country should make a savings allowance for the resources that it: (a) extracts; or (b) uses to support its domestic economy. The former includes exports of resources but excludes imports of resources and vice versa for the latter.

The issues are complex and subject to different interpretations. However, the findings suggest that the onus is on the resource exporter to re-invest the value of depletion of natural resources whether for export or not. With this in mind, the investigation of international trade links via resource trade should be undertaken as a distinct exercise to that of measuring a particular country's genuine savings rate. Carrying out this analysis enables quantification of the

extent that for example, European countries import resources in order to support the European economy. In addition, it enables these imports to be traced back to the (primarily) developing countries from where they were extracted.

### **Indicators of Strong Sustainable Development**

Indicators of strong sustainability can be integrated with indicators of genuine savings. The key indicators for the economy operating under this strong sustainability regime will be twofold:

- are stocks of critical natural assets declining?
- are genuine savings rates persistently negative?

If the answer to *either* of these questions is yes then this economy will still eventually experience declining levels of well-being: i.e. it will be unsustainable.

Determining what constitutes a critical natural asset is a key future challenge - for strong sustainability cannot possibly mean that all natural assets must be preserved. Selection of these critical assets may depend on the elaboration of a plausible theory of strong sustainable development. One of the most appealing of these is the theory of *ecological resilience*: the ability of an economic, ecological and social system to 'bounce back' from shocks (such as outbreaks of disease) and to persist despite continuous stresses.

This theory suggests that measurement of strong sustainability should focus on indicators of biodiversity for which, fortunately there is a flourishing amount of research. In practice, however, diversity measures are problematic because there is no natural origin for such a measure. One may be able to claim that diversity has increased or decreased but it is not possible to say what level of diversity is required for sustainability.

### **Sustainability and Valuation: Two Case Studies**

Indicators of strong sustainability are usually envisaged in physical terms. However, one cannot rule out the possibility of valuing natural assets, even those that provide so-called ecological benefits (e.g. 'life-support functions'). The case studies have analysed particular land areas which can be defined as natural assets: the Dutch Wadden Sea area and the Mediterranean forests of Portugal and south-west Spain area.

- The results indicate that household willingness-to-pay (WTP), to achieve a natural - conserved - state for this area, varies positively with the amount of information respondents have regarding the environmental services supplied by the Wadden Sea asset. Combining this finding with strong sustainability attributes of uncertainty about ecosystem functions and scale of impacts of irreversible losses of natural assets suggests caution in relying solely on monetary indicators of sustainability, at least in some contexts.

- The focus of the case-study of Iberian forests - montados and dehesas - is the provision of these assets of both commercial and environmental benefits. The valuation survey of the latter sought to estimate the current and (option of) future recreational benefits enjoyed by visitors to the dehesa in Monfragüe Natural Park.

Combining these results in a green regional account with constructed accounts of local agricultural activity facilitates the analysis of policy that would help to strike an appropriate balance between commercial agricultural activities and environmental benefits. In particular, if the balance is sought in favour of increased conservation at the expense of the agricultural activity then policy intervention must focus on making land-owners' incentives compatible with this new balance. If this is achieved then it follows that the sustainable development of these regions - and their contribution to national sustainability - will be enhanced.

### **Social Sustainability**

The achievement of sustainable development has an often neglected social component. The question here relates to how notions of distribution *between* generations should be augmented to reflect concern about distribution *within* generations. The answer has some connection with the nature of wealth ownership, or at least, entitlement. This may serve to again underline the importance of human capital, to sustainable development, especially since human capital is inherently specific to the individual and raises individual capabilities.

Yet the project concluded that in terms of indicator work, it is unclear what informational gains are to be made by constructing composite indicators of current distributional concerns (e.g. the Human Development Index) and sustainability indicators (e.g. indicators of genuine savings or critical natural assets).

Green national accounting can inform this debate by linking environmental data to social information in social accounting matrices (SAMs). However, the conceptual question of how this analysis would fit into existing theories of sustainable development is one that must be resolved outside of the accounts and indicator work in general. Currently, however, it is difficult to say much more, although some progress may be made via the notion of social capital.

### **Results for Central and Eastern European Countries (CEEC).**

The results showed that, for example, Bulgarian households are willing to forego values of 300- 500 BGL per year (1-2% of the average sample monthly income) in order to obtain increased conservation of monasteries. Similarly, Hungarians are willing to pay an average of 3900 HUF every year for a Balaton clean-up programme. This corresponds to approximately 1% of *net* annual earnings.

CVM is flexible in that it can be used to elicit preferences for diverse benefits in any number of different context. The conclusions in this regard were that,

- The CVM can be applied *successfully* in transition economies and could provide an important and additional tool for policy-makers :
- the results appear to perform well when tested against accepted reliability and validity criteria;
- intensive background research on physical impacts and public opinion is a prerequisite for successful implementation. This information also appears to be of interest in its own right.

In addition to providing evidence for the applicability of CVM in a transition economy context, the work makes two important methodological contributions. Specifically,

- budget reallocation tests can be used to provide supplementary information to monetary estimates of benefits (obtained by CVM). This exercise can inform the acceptability of policies to finance environmental improvements. The results obtained give tentative support for policies that involve a portfolio of instruments;
- the presence of lexicographic preferences is tested using two novel and rigorous tests. These do not appear to indicate the existence of lexicographic behaviour in the Bulgarian sample of respondents. These tests may prove useful for future research on this important question.

### **Overall Conclusions**

The study of the measurement and achievement of sustainable development brings together a diverse range of concerns, connected by the desire to safe-guard the opportunities of future generations. This research has reflected this diversity. It has shown that it is possible to measure sustainable development and that at the heart of this effort will be some form of green national accounting. Indeed, governments and national and international statistical offices have themselves recognised this as revealed in the implementation of official resource and environmental accounting frameworks.

A key aspect to this work is the construction of improved measures of savings and wealth such as genuine savings. Of course, this concept needs to be augmented to consider a rich array of sustainability concerns. In particular, the research has highlighted the health costs of pollution, international trade, social sustainability and the integration of measures of genuine saving with indicators of critical natural assets. Lastly, by focusing in greater detail on particular natural assets, the valuation case studies have highlighted both the importance of environmental benefits and the need to strike a balance with conventional economic activity.

## **IV. SCIENTIFIC INTEREST AND POLICY RELEVANCE**

### **(i) Scientific interest and novelty**

The findings have provided further evidence that formal approaches to sustainable development can yield novel insights. For example, much of the debate surrounding appropriate green alternatives to GNP has proceeded without reference to a theory of sustainability. However the research project has shown that being mindful of such underpinnings can lead to the possible resolution of such issues as the treatment of resource discoveries, defensive expenditures, and valuation of pollution damages. The genuine savings approach is a direct result of this formal

approach and has yielded new information and been well-cited in the sustainable development literature. Although, one of the initial criticisms of the measure was that it only deals with weak sustainability the research has shown how, under a strong sustainability regime, genuine savings are complementary indicators to 'stronger' indicators based on changes in critical natural assets. It has also been demonstrated that as it is persistently negative genuine savings that indicate non-sustainability, this criterion should form the basis of a genuine savings rule.

International trade and the environment has been the subject of considerable investigation in the research community. Hence, one would expect this research to be of significant interest for three reasons. Firstly, through the presentation of a general equilibrium model of trade and environmental policy and by the consideration of a sustainability constraint in this context (see, Klepper and Stahler, 1995). Secondly, by demonstrating that resource trade does not change the substance of the genuine savings rule so far developed. While this result fits in with current green national accounting practice it is contrary to the theoretical findings of Asheim (1986), Hartwick (1995) and Sefton and Weale (1995).<sup>1</sup> Lastly, by presenting a framework for analysing trade flows between countries.

In terms of CVM research, the implication of our Wadden sea valuation work is that it is extremely important to identify the relevant characteristics and perceptions of a good in order to obtain a valid and reliable estimate of WTP. Conducting focus groups and ensuring adequate pretesting of questionnaires are essential in this regard, in addition to the use of personal interviews (rather than mail interviews used here). If the available budget prohibits this (as was the case in this study), it seems advisable to keep the description as complete as possible and to check whether respondents considered the information given as sufficient for deciding upon their WTP.

The valuation case of dehesa and montados can be seen as an empirical application of a approach to green national accounting suggested by Hartwick (1992).<sup>2</sup> Land is defined as the asset and changes in land-use is associated with changes in the stream of benefits associated with the existing use (e.g. increased agricultural production boosts farmers profits but may lower the environmental benefits derived from the land). The type of estimates - commercial and environmental - derived from this study could be used to construct regional environmental accounts for the dehesa region and thus regional green accounting aggregates. Alternatively, these values could be used to evaluate the net benefits of different land uses.

The results from the CEEC's showed that the primary contribution of this extension of the research to Central and Eastern European countries was to show that valuation techniques can be *successfully* applied in a transition economy context. To our knowledge, the Bulgarian, Hungarian and Polish studies were only the second contingent valuation surveys to be implemented in each of those countries. Moreover, the Hungarian study was certainly the first *large-scale* survey (2000 respondents) of this kind to be implemented there, while the Bulgarian study was one of the few studies, conducted anywhere, that attempt to value cultural goods. In this latter regard the research provided a comprehensive illustration of a methodology to estimate the social cost of cultural heritage degradation.

The lessons these studies provide is that implementation of CVM in transition economies (as arguably anywhere) will only be successful if preceded by an intensive background study including consultation with experts and data collection. This will form the basis of draft versions of questionnaires which will need to be pre-piloted (general testing of public opinions and reactions to the study in hand). For example, focus group testing was undertaken to gauge public awareness and attitudes towards traffic calming in Cracow.

## **(ii) Policy relevance**

In September 1995, the World Bank published the document "Monitoring Environmental Progress". A core chapter of this volume adopted this project's definition of genuine saving as a key indicator of sustainable development. This

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1 Asheim, G.B. (1994) "Net National Product as an Indicator of Sustainability", *Scandinavian Journal of Economics*, 96: 257-265; Hartwick, J.M. (1994) "Sustainability and Constant Consumption Paths in Open Economies with Exhaustible Resource", Paper prepared for the AERE Conference, Boulder, Colorado, June 5th 1994. Sefton, J. and Weale, M. (1996) "The Net National Product and Exhaustible Resources: the Effects of Foreign Trade", *Journal of Public Economics*, forthcoming.

2 Hartwick, J.M. (1992) "Deforestation and National Accounting", *Environmental and Resource Economics*, 2: 513-21.

endorsement of the genuine savings concept emphasised the continuing policy relevance of this aspect of the research.

In terms of policy, countries can increase their genuine savings by:

- ensuring that resource royalties do not encourage over-extraction or over-harvest;
- implementing pollution taxes and charges to reduce pollution to socially efficient levels. With the indication of large costs associated with PM10 emissions given above these comments are particularly relevant. These costs relate to *all* emissions of PM10 and hence care needs to be taken in interpreting their policy relevance - no policy could aim at eliminating all particulate matter, or any other pollutant for that matter. Nonetheless, these results suggest a powerful argument for further control of air pollution in Europe.
- focusing on macro- and microeconomic policies that encourage households to save rather than consume;
- investing in human capital - particularly education - and in doing so not only increase the level of investment but also the *quality* of that investment. One sure means to increase genuine savings is in investment in education. If the notion of capital is expanded to include human capital, then this would add 2-8 percent to genuine savings rates by country. Pushing the thinking in this direction leads naturally to the conception of development as a portfolio management, where the aim of development policy is to meet social goals-by achieving the appropriate mix of produced assets, natural assets and human resources.

In terms of international trade and sustainability the following are suggested as policy relevant aspects of this work.

- When a natural resource is sold at the border price in international markets, the full value of this sale shows up in the conventionally measured national income of the exporting country. However, a part of this income is in fact the liquidation of an asset, as measured by the value of depletion. This suggests that investment policies (in terms of investing resource revenues) should also form a component of policies aimed at trade expansion. The success of such a policy could be monitored by genuine savings.
- In practice, many developing countries may have difficulties meeting this savings requirement. Yet, if there is a strong resource trade link between country A (developed) and country B (developing) and country B is behaving unsustainably (i.e. has persistently negative genuine savings) then country A may choose to address this problem through its bilateral aid programme. Of course, this will depend on the extent to which A cares about B's apparently unsustainable behaviour.
- If the concern is that some countries are over-extracting resources in order to satisfy the import requirements of others this also suggests a role for international co-ordination.

The case study work points at both the need for detailed monetary valuation of natural assets and changes in these assets. With regard to the Iberian work this points towards policies to maximise the net benefits of land-use in the dehesa and montados regions - i.e. the mix of land-uses that secures the greatest social return. Quantifying the environmental benefits often provides a powerful rationale for policies that increase the share of natural assets in this overall mix. However, farmers incentives must be consistent with the desired level of conservation and arguably, farmers may require compensation for the loss of commercial revenues as a result of say, an increased conservation effort in dehesa and montado region, although it should be noted that commercial returns are currently inflated by farming subsidies. Such considerations are familiar from the literature on incremental costs.

The Wadden sea valuation work, pointed to the difficulties of valuing natural assets that provide complex ecological benefits. This task is not impossible but is especially sensitive to the amount of information offered to respondents. This may indicate that by providing more detailed information on the goals of environmental policy, the public's willingness to support - and in turn WTP - for these policies may be enhanced. All this suggests at least some scope for enhancing support for environmental or sustainability policies by increasing public awareness of potential gains from these policies (or at least give people a better index against which to weigh costs).

For the Central and Eastern European Countries, given that policy makers have tended, sometimes, to overlook the full value of environmental and cultural goods when making decisions regarding the allocation of resources between competing uses, this research project, in a small yet significant way, addressed this imbalance. Hence, if this neglect has arisen from the absence of monetary values then our contribution to the policy domain has been to fill that gap, for example, by providing data on the value of preserving what has become Bulgaria's most famous cultural symbol - the numerous remaining Christian Orthodox monasteries. These values can then be used in cost-benefit analysis of measures to decrease damage to cultural property, moving society in the direction of increased conservation effort.



A further example of this policy usefulness is indicated in the case of the Cracow traffic calming study. In terms of valuation, our interest is in what an average resident would be willing to pay for these benefits.

In addition to relevance to policies designed to enhance social well-being (through increased provision of non-market goods), our investigations have also been relevant to marketed (i.e. commercial) aspects of goods. For example, the Lake Balaton study has implications for tourist revenues and thus employment opportunities in the area.

With regard to policies that move economies in Eastern Europe towards sustainable development, although we have not anchored our studies to any formal model of sustainability some useful inferences can be made. Thus, our results indicate that the sustainability of cultural capital in transition economies might include monastery conservation as a core component. Of course, we would add the caveat that this assertion needs to be critically appraised with additional evidence, for example on the opportunity costs of conservation.