Contribution to Beyond GDP „Virtual Indicator Expo“

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Name of the indicator/method: (**environmentally) Sustainable National Income (eSNI)**

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The need for eSNI

Standard national income (NI) is in politics, newspapers and most economic literature identified with economic growth and economic success. However, according to economic theory economic success can solely mean increase in welfare (the satisfaction of wants derived from our dealings with scarce means). Welfare is dependent on more factors than the production and its growth as measured in NI. Examples are: labour conditions, income distribution, employment, and, of course, the possible uses c.q. environmental functions of our non-human made physical surroundings (the environment). The latter encompasses renewable and non-renewable resources, including biodiversity and the life support systems of our planet. Humanity is completely dependent on these non-human made environmental functions. Since the use of functions is going more and more at the expense of other functions, environmental functions have become by definition scarce goods, indeed the most fundamental scarce goods humanity disposes of. Loss of one or more vital functions leads to a drop in production (see Figure 1).

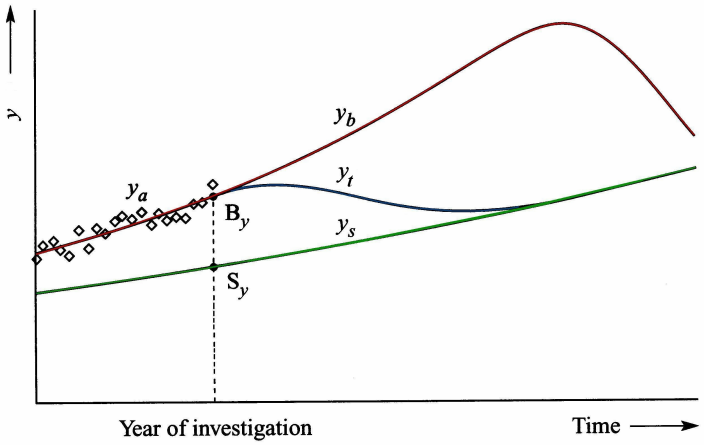

Figure 1 *Actual standard national income observations (y_a, fictitious example) compared with the net national income (y) on three optimal paths, calculated with a dynamic environmental economic model. The red path (index b, business as usual) approximates the actual path (index a) by assuming incomplete expression of preferences for the environment. These preferences are assumed to be completely expressed on the sustainable path (index s) and the transition path (index t). The point B_y indicates the level of national income y on path b in the year of investigation; Sy is the corresponding point on the sustainable path s. The path b drops dramatically because of the loss of one or more vital environmental functions, as happened already in some regions* (http://www.millenniumassessment.org/en/condition.aspx).

In standard economic theory producing is defined as adding value. *This value is added to the non-human made physical surroundings*. Consequently, environmental functions that are indispensable for human life, including production, remain outside the measuring of standard NI. This is logical because water, air, soil, plant and animal species are not produced by humans. So in view of the widespread perception that NI indicates economic welfare and success and even that production has to grow for financing environmental conservation, we greatly need an

NI adapted for environmental losses, alongside the standard NI, in order to counter this wrong perception.

This is the (environmentally) Sustainable National Income (eSNI). The eSNI is the only indicator which (1) is directly comparable with standard NI because it is estimated in accordance with the conventions of the System of National Accounts (SNA), (2) relates the measurable physical environment ('ecology') with subjective preferences (economy) as shown in Figure 2, (3) provides the distance between the actual (NI) and sustainable (eSNI) production level in factor costs and (4) shows the development of this distance in the course of time and thus shows whether or not society is drifting further away from environmental sustainability defined as keeping vital environmental functions available for future generations. Therefore the eSNI is indispensable information for society and policy.

Description

Environmentally SNI in a given year is defined as the maximal attainable production level by which vital environmental functions remain available for future generations, based on the technology available at that year (the OECD has accepted this definition http://stats.oecd.org/glossary/detail.asp?ID=6587). Thus the eSNI provides information about the distance between the current and a sustainable situation. The length of the period to bridge this distance, that is the transition period towards a sustainable situation, is limited only by the condition that vital environmental functions must not be damaged irreversibly. In combination with the NI, the eSNI indicates whether the part of the production that is based on *un*sustainable use of the environment is increasing or decreasing. Because of the precautionary principle, future technological progress is not anticipated in the calculation of eSNI. When constructing a time series of eSNI's, technological progress is measured after the event on the basis of the development of the distance between the eSNI and standard NI over the course of time. When this distance increases, society is drifting farther away from environmental sustainability, and vice versa.

In our physical surroundings, a great number of possible uses can be distinguished, which are essential for production, consumption, breathing, et cetera, and thus for human existence: environmental functions, or in short: functions. As long as the use of a function does not hamper the use of an other or the same function, so as long as environmental functions are not scarce, an insufficiency of labour, that is intellect or technology, is the sole factor limiting production growth, as measured in standard NI. As soon as one use of a function is at the expense of another or the same function (by excessive use), though, or threatens to be so in the future, a second limiting factor is introduced. The emergence of competition between functions marks a juncture at which functions start to fall short of meeting existing wants. Competing functions are by definition scarce and consequently economic goods. In a situation of severe competition between functions, in which we live today, labour is not only reducing scarcity, and thus causing a positive effect on our satisfaction of wants (welfare), but it is also increasing scarcity, thus causing a negative effect on welfare. The same holds for consumption. So today production not only adds value (viz. goods for consumption) but also nullifies value (by damaging environmental functions). Examples of competing functions are: the function 'air, water and soil as dumping ground for waste' with functions like 'air for physiological functioning', 'drinking water' and 'soil for raising crops'; the functions 'space for growing food crops' and 'space for natural ecosystems such as forests' with the function 'space for growing biofuel crops'; the function 'regulating the water flow of e.g. forests' (that prevents flooding) with the function 'forests for harvesting wood'.

The availability of functions, or, in terms of the SNA, their volume, decreases from 'infinite' (abundant with respect to existing wants) to finite, that is falling short. As a result, the shadow price of environmental functions rises, and with it their value, defined as price times quantity, from zero to an ever-higher positive value. *This rise in value reflects a rise in costs*. To determine the extent of the loss of function, we must know the value of the function. Since envi-

ronmental functions are collective goods that are not traded on the market, supply and demand curves have to be constructed. Without data on both preferences as well as on opportunity costs, determination of value is impossible.

The estimated costs of measures necessary to restore functions, that rise progressively per unit of function restored, can be seen as a supply curve, because the measures supply the availability of functions. We call this the cost-effectiveness curve or the elimination cost curve, because it refers to measures that eliminate the pressure on the environment. Except in the case of irreparable damage, this curve can always be constructed. The measures consist of technological measures, stimulating direct shifts such as from private car to bicycle and stimulating birth control. For non-renewables elimination measures take the form of developing and bringing into practice alternatives such as solar for fossil fuels.

Preferences for environmental functions, on the contrary, can only partially be determined, since these can be expressed only very partially via the market, while willingness to pay techniques cannot yield reliable data precisely for vital functions. Their expression via the market and budget mechanism is blocked by so called blockages or barriers (www.sni-hueting.info). Therefore it is not possible to construct a complete demand curve. In order to provide the necessary information, assumptions about preferences have to be made. In the physical environment these assumptions take the form of physical standards. See Figure 2. It follows from the previous sentences that (1) these standards have to be clearly distinguished from whether or not people are willing to attain them and (2) they contain *information* and are by no means actual political target setting. *One* possible assumption is prevailing preferences for sustainable use of vital environmental functions, which takes the form of a rectangular, curve d' in Figure 2. This assumption is legitimate because governments and institutions all over the world have stated support for this.

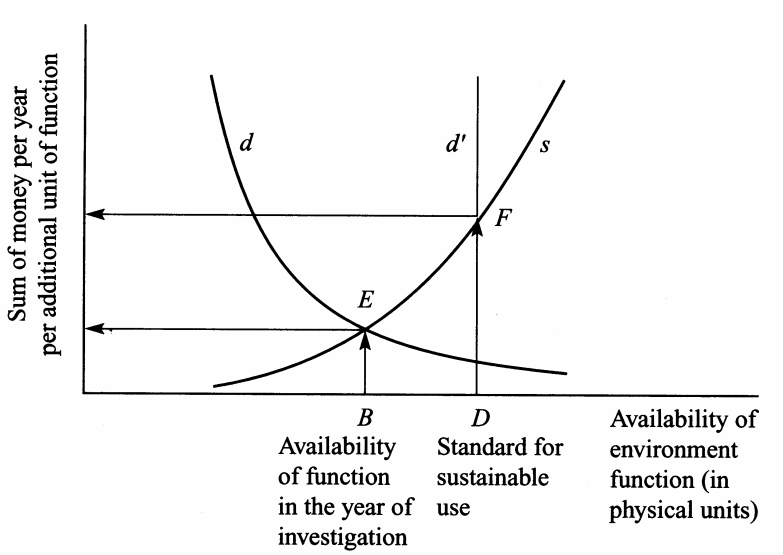

Figure 2 *Translation of costs in physical units into costs in monetary units: s = supply curve or marginal elimination cost curve; d = incomplete demand curve or marginal benefit curve based on individual preferences (revealed from expenditures on compensation of functions, on restoration of physical damage due to loss of function e.g. the 'hydrological regulation' function resulting in erosion, and so on); d' = 'demand curve' based on assumed preferences for sustainability; BD = distance that must be bridged in order to arrive at sustainable use of environmental functions; area BEFD = total costs of the loss functions, expressed in money; the arrows indicate the way via which the loss of environmental functions recorded in physical units is translated into monetary units.*

The cost-effectiveness calculations and the standards are input in an economic model that has as output among other things the level of eSNI and the prices of products in a sustainable situation, with strongly changed price ratio's between environment burdening (much higher real prices) and less burdening products (about the same real prices).

A first rough estimate of the eSNI for the world in 1991 by Tinbergen and Hueting arrives at fifty percent of the production level of the world: the world income (www.sni-hueting.info). Estimates for The Netherlands by a co-operation of Statistics Netherlands, the Institute of Environmental Studies and the Netherlands Environmental Assessment Agency also arrived at about fifty percent of the production level or national income (www.sni-hueting.info).

This corresponds with the production level in the early seventies. *Consequently our production level is two times higher than the level that can be sustained for future generations*.
In the period 1990-2000 the distance between NI and eSNI increased by thirteen billion euro. (http://ivm5.ivm.vu.nl/sat/?chap=14)

History

The concept of eSNI has been designed by dr. Roefie Hueting and has been worked on since the mid 1960's, since 1990 together with ir. Bart de Boer. Central in the theory is the concept of environmental function. A difficult problem has been to establish the value of these functions and consequently the costs of their loss in order to arrive at an NI adapted for loss of environmental functions. In his cum laude dissertation New Scarcity and Economic Growth (1974) and later publications Hueting arrives at the conclusion that this problem is insolvable, that consequently the correct prices of market goods are equally unknowable, but that the indispensable information for policy weighing can be given on the basis of estimates of factor costs and making assumptions about preferences. This 'solution' of the valuation problem holds true and is applicable for both not in GDP recorded environmental losses and other shortcomings of GDP. It is widely accepted, never disputed and can for instance be found in the article that he wrote together with Nobelist Jan Tinbergen for the Rio conference in 1992: 'GNP and market prices: wrong signals for sustainable economic success that mask environmental destruction' (Tinbergen is one of the founders of the GNP/GDP indicator in the 1930's and has strongly supported Hueting's efforts to estimate a figure *alongside* the GDP, right from the start in the mid 1960's)

The work on eSNI received the Global 500 Award, the royal honour Officer in the Orde of Oranje Nassau and a nomination by Jan Tinbergen for the Sasakawa Prize. International symposia on eSNI were organised at the Royal Academy of Art and Sciences in Amsterdam, by the OECD in Paris and by The World Bank in Washington D.C. At the latter occasion the book 'Economic Growth and Valuation of the Environment: a Debate', dedicated to eSNI and with comments on eSNI by the world's most outstanding environmental economists such as Daly, Pearce and Beckerman, was handed by minister Pronk to WB president Wolfensohn in 2001 (http://info.worldbank.org/etools/bspan/PresentationView.asp?PID=494&EID=235). In the SEEA manual of the UN Statistical Office is written: "Much of the initiative to look at an alternative path for the economy rather than a different measure of the economy came from the work of Hueting in the late 1960's and the early 1970's. He introduced the concept of environmental function referred to throughout this manual, explaining how pressure on functions leads to scarcity or competition for these functions (…)."
(http://unstats.un.org/unsd/envaccounting/seea.asp).

An estimate of eSNI for the world was made in 1991. Estimates of eSNI for The Netherlands are made for the years 1990, 1995 and 2000. A multidisciplinary team of biologists, chemists, physicists, electrical engineers and economists worked for nearly forty years on the eSNI and the environmental statistics it is based on.

Future

Plans are elaborated in notes for (1) model improvements, (2) the set up of, among other things, defining the measures and estimating their costs to arrive at sustainable use of soil that prevents erosion, one of the serious problems in developing countries and (3) eSNI estimates in other countries e.g. Germany and some developing countries. Representatives of The World Bank and the OECD have insisted on this. Although the Dutch Parliament has asked for funding this and the Dutch government has promised to do so, subsidies have not been granted. The theory and elaboration of the eSNI has received international scientific recognition. It is the eldest and most complete environmental indicator as follows from e.g. the four points mentioned in the Section 'Need'. It provides information not given by any other indicator. However, because of lack of funding further development of the eSNI is hardly possible. Hopefully the European Union will help to change this situation.