ON THE MEASUREMENT OF THE ENVIRONMENTAL COMPONENT OF DEVELOPMENT

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Abstract: *Environment indicators are especially appealing when studying development and that constituent dimension of the phenomenon. This paper presents two distinguishing categories of environment indicators, delimiting them from a much wider set of indicators – sustainability indicators. Total Material Requirements, Natural Capital, and Ecological Footprint are environmental indicators with an aggregate character that should be considered in more detail when monitoring the state of the environment (including its sustainability).*

Key words: *Development; Environment; Measurement; Indicators.*

1. INTRODUCTION

An appropriate measurement of development and its dimensions is a priority for the evaluation of the level of development of countries/regions. A disaggregated account of the phenomenon can go hand in hand with the systematic use of indicators such as real income per capita or the Human Development Index (HDI). Taking into account a wide range of more specific indicators does provide a more complete vision of the various dimensions of development. In addition, one can have composite measures of development that combine a more restricted set of indicators representing a multivariate vision of the phenomenon. In both ways, the main challenge consists of capturing, on an adequate manner, the multidimensional nature of the concept present in the current conceptions of local, human, and sustainable development.

The environment is a crucial dimension of development. A decisive importance has been given to it, namely in the context of the emergence of the sustainable development concept. The measurement of the environmental dimension of development falls within the much wider issue of measuring sustainability, but cannot be confused with it. The depletion of natural resources and environmental degradation are important challenges to environmental sustainability and indeed reflected in the concept of sustainable development. However, this concept is multidimensional in nature and therefore goes beyond the environmental dimension of sustainability. For an evaluation of the level of natural resources available, which also reflects the inter-generational issue in relation to environmental assets, one needs "pure" environmental indicators.

The purpose of this paper is to identify and discuss the environmental indicators which are appropriate for measuring the environmental component of the development of nations. Section 2 gives emphasis to the most widely used sustainability indicators for countries/regions which are, inevitably, the reference when one studies the environment and development. Section 3 presents indicators that are environmental in nature taking into

account two measurement approaches – the environment accounts and the composite measurement of environment. Section 4 presents some conclusive observations.

2. SUSTAINABILITY INDICATORS

Three recent surveys on the measurement approaches of sustainability are Roseta-Palma and Meireles (2008), Stiglitz *et al*. (2009), and Hizsnyik and Toth (2010). In the survey of Hizsnyik and Toth (2010), for instance, one stands out the following three main measurement approaches: (i) indicator lists and subsets; (ii) capital and accounting frameworks; (iii) composite indicators.

The first approach in the measurement of sustainability for countries/regions may encompass an unstructured set of indicators (list of stand-alone indicators), a set of indicators sorted into thematic groups (e.g. economic, social, environmental, and institutional) or indicators organized by hierarchical levels. One of the early efforts to compile a list of sustainability indicators goes back to 1996 and to the United Nations Department of Economic and Social Affairs (UNDESA). The last edition of the UN Commission on Sustainable Development (CSD) – UNDESA (2007) – classifies the indicators on the issue in 14 themes and 44 sub-themes. Poverty and natural disasters are transversal themes showing that the early division into the four pillars of sustainable development (economic, social, environmental, and institutional) is no longer explicit in this third and last edition.

The capital and accounting frameworks are part of the national accounting framework. In the first case, the mainstream economic accounting complements the produced capital goods and financial capital by the imputed values of natural, human, social, and institutional capital stocks. Under this framework, the non-declining volume of national wealth (defined as the sum of all capital stocks) is the key sustainability criteria. Satellite accounts measuring certain environmental attributes represent another approach to integrating sustainability concerns into traditional economic systems. Among some indicators considered under this second measurement approach of sustainability are the Index of Sustainable Economic Welfare (ISEW), the Genuine Savings (GS) indicator, and Sustainable National Income (SNI).

The last approach aggregates into an index social, economic, and environmental concerns for sustainability evaluation. A variety of sustainable development indices are available in the literature, among which one highlights the Environmental Sustainability Index (ESI), the Wellbeing Index (WI), the Ecological Footprint (EF) and the Dashboard of Sustainability.

The disaggregation of the literature on the subject produced by Stiglitz *et al*. (2009) or Roseta-Palma and Meireles (2008) is different from the one advanced by Hizsnyik and Toth (2010). However, a comparative analysis of these surveys reveals that the most widely used indicators for the evaluation of the sustainability of nations are, essentially, the following:

(i) ISEW, whose most recent information is made available by Friends of the Earth;
(ii) GS, included in the World Development Indicators compilation published by the World Bank (WB);
(iii) ESI and its successor, the Environmental Performance Index (EPI), both a conjunct initiative of the Yale University (YCELP) and the Colombia University (CIESIN);
(iv) EF calculated by the Global Footprint Network.

3. ENVIRONMENTAL INDICATORS

3.1 Environment Accounts

The System of Environmental and Economic Accounting (SEEA) – developed by the UN, the European Commission, the IMF/International Monetary Fund, the OECD/Organization for Economic Cooperation and Development, and the WB (UN *et al*., 2003) – extends the system of national income accounts (SNA) by incorporating the role of the environment and natural capital in the economy through a system of satellite

accounts (environment accounts). A wide range of indicators can be derived from the SEEA accounts of which Lange (2007) considers the following categories: (i) indicators of the NAMEA (National Accounts Matrix including Environmental Accounts) component of SEEA; (ii) indicators derived from the Material Flow Accounts; (iii) measures that revise existing macroeconomic indicators; (iv) measures that estimate new, hypothetical macroeconomic aggregates. The first two categories encompass physical aggregates while the last two gather monetary aggregates. Table 1 presents the "pure" environmental ones.

Table 1: Main environmental macroeconomic indicators derived from SEEA

Indicators from the NAMEA system developed by Netherlands
- Greenhouse Gas Emissions (GGE)
- Acidification
- Eutrophication
- Solid Waste
Indicators associated with material flow accounts
- Total Material Requirements (TMR)
- Direct Material Input (DMI)
- Net Additions to Stock (NAS)
- Total Domestic Output (TDO)
- Domestic Processed Output (DPO)
Measures that revise existing macroeconomic indicators
- Total wealth and its main sources (produced assets, natural capital assets, human capital)

Source: Adapted from Lange (2007).

As can be observed in Table 1, the first source of indicators (NAMEA) provides physical indicators for main environmental themes such as climate change, atmosphere acidification, eutrofization, and solid waste. The second source gathers a set of indicators, among which the well-known TMR, aggregating the entire material use of an economy. The last environmental indicator presented in Table 1 consists in the estimate of Natural Capital (NC) using an approach based on wealth and its composition.

3.2 Composite Measurement

The proliferation of sustainability indices – as the ones referred in a number of surveys on the issue like Böhringer and Jochemc (2007) or Singh *et al*. (2009) – occurs mainly during the nineties. However, those initiatives exclusively centered on the environmental component are considerably lower. On the other hand, an analysis of the dimensions captured in some of the indices whose name suggests as being purely environmental in nature ended up as not being so. This is the case of the widely diffused ESI and its successor EPI. Table 2 presents the environmental indices found in the following surveys on the broad issue of sustainability: (i) Böhringer and Jochemc (2007); (ii) Goossens *et al*. (2007); (iii) Bandura (2008); (iv) Mayer (2008); (v); Saisana (2008); (vi) Singh *et al*. (2009). The in-depth analysis into the dimensions covered by the given indices was based on the environmental nomenclature proposed by UNDESA (2007).

Table 2: Composite measurement of the environment and its sub-dimensions

Author/Organisation	Environmental Indices	Environmental Dimensions			
		Atmosphere	Water	Land	Biodiversity
Burck and Bals (2009)	Climate Change Performance Index (CCPI)	X			
Ewing *et al*. (2009)	Ecological Footprint (EF)	X	X	X	
Hails *et al*. (2008)	Living Planet Index (LPI)				X
ten Brink (2000, 2007)	Natural Capital Index (NCI)				X
Jha and Murthy (2006)	Environmental Degradation Index (EDI)	X	X	X	
Esty *et al*. (2002)	2002 Pilot Environmental Performance Index (EPI)	X	X	X	X
Jones *et al*. (2002)	Index of Environmental Indicators (IEI)	X	X	X	X
CBD (2001)	National Biodiversity Index (NBI)				X
Puolamaa *et al*. (1996)	Index of Environmental Friendliness (IEF)	X	X	X	X
Adriaanse (1993)	Environmental Policy Performance Index (EPPI)	X	X	X	

The list presented in Table 2 illustrates the diversity of the indices in terms of its dimensional coverage. At one extreme, there are indicators capturing a particular dimension of the specified conceptual structure, that is, three indicators related to the biodiversity dimension (LPI, NCI, and NBI) and one indicator focused on the evaluation of countries' performance on climate change (CCPI). At the other, one has three indicators covering all the environmental dimensions considered – 2002 Pilot EPI, IEI, and IEF. Finally, given the indicators listed in Table 2, only the first three are currently regularly published – CCPI, EF, and LPI.

4. FINAL REMARKS

An appropriate measurement of development needs indicators for its main constituent dimensions taken as both in a disaggregated and composite manner. The environment is one of these crucial dimensions of development, whose present debate on the different ways to be measured allows one to identify the environmental indicators that should be part of a proposal on measuring development.

On the issue of sustainability and the appropriate indicators for its measurement, the four initiatives that stand out in this paper – ISEW, GS, ESI/EPI, and EF – are composite in nature and thus contrast with dashboards or set of indicators for sustainability evaluation. In addition, there is a difference between sustainable development indicators and indicators of environmental sustainability. Only one out of the four considered indicators focuses on the environmental dimension of the phenomenon being a "pure" environmental indicator – the EF (with its associated indicator, the Biocapacity).

In the context of the specialized literature on the measurement of natural capital a number of additional environmental indicators were identified in this paper. TMR, NC, and EF are the three initiatives one should select as the most appropriate for a constant monitoring of the state of the environment (including its sustainability). However, a complementary approach for the measurement of the environment could/should be adopted, one that considers indicators for a more detailed and in-depth analysis of the state of the environment and thus allowing for a more complete perception of the phenomenon.

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