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Studies on Indicators for Sustainable Development: An Integration of Environment and Economics

PhD thesis

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Summary

Purpose and structure of the thesis

The thesis has two large parts. The first one – covering chapter 1 and 2 – is the survey part, while the second part – covering chapter 3 and 4 – includes my own calculations.

First, I would briefly like to talk about the survey part. The purpose of this survey is to see if there are any robust and well-founded indicators/indicators systems that can take comparative and critical analysis of our progress towards sustainable development.

Background

Although the welfare content of the national income had been the subject of discussion during the development of national income theory, the finally standardized calculations in the SNA in 1953 focused on the needs of Keynesian economic policy planning, and not on welfare. The Gross Domestic Product (GDP) has many elements that are welfare related, but there are some that have little or no relevance to welfare. Furthermore, Kapp, Mishan and others very early pointed out that maximizing production and economic growth will take its toll in other dimensions of welfare, most notably in the environment. Despite the warnings, politicians, decision makers and the public increasingly started measuring success as economic growth expressed in the GDP figures. At the same time the group of economist unhappy with the hegemony of the GDP was growing and the first concrete suggestions for alternative indicators were constructed in the 1970's. In the early 1990's the criticism of economic growth at all costs, especially at the cost of future generations, received international support and official backing through the wide spread acceptance of the concept of sustainable

development. While the search for indicators of welfare continued, the long term goal of sustainable development prompted research for the development indicators that can address the multi-dimensionality and intertemporal aspects of sustainable development.

Chapter 1

I provide a brief summary on the development of the national income theory. Observing contributions and thoughts from Petty, A. Smith, Marshall, Pigou, Hicks and Kuznets, Kneese among others helps us understand why the GDP is constructed the way it is.

It is followed by the analysis of three influential suggestions, the Measure of Economic Welfare (MEW) by Nordhaus and Tobin, and the Net National Welfare (NNW) of Japan and the Index of Sustainable Economic Welfare (ISEW). These indicators try to express economic welfare better than the GDP through the exclusion of some items that are not welfare increasing and the inclusion of new categories that either increase or decrease economic welfare. MEW and NWW show increasing economic welfare over the observed periods, but the growth rate is lower than the growth rate of the GDP. ISEW shows similar trends until the 1970's, but no improvement since then.

Chapter 2

The first section in Chapter 2 describes the concept of Sustainable Development: the new dimensions and requirements with regard to indicators. In the main part of Chapter 2 I review the most influential suggestions for alternative indicators. They were chosen based on their frequency of appearance in economic literature and reference to them in related papers. The single indicator vs. indicator framework conflict was chosen as the main line of the overview. The indicators covered are

- Environmentally Adjusted Domestic Product (EDP) ('green GDP')
- Greened Economy GDP (geGDP) and Sustainable National Income (SNI)
- Human Development Index (HDI)
- Ecological footprint
- Total Material Requirement (TMR) and Material Input Per unit of Service (MIPS)
- Sustainable Value Added (SVA)
- Food miles
- The NAMEA Theme indicators
- Commission for Sustainable Development (CSD) Theme indicators (DSR and PSR frameworks)

- Eco-efficiency and eco-intensity indicators

At the end of Chapter 2 I elaborate on the usefulness and dangers of aggregation. Generally, we can point out that single indicators often lack transparency. The choice of the unit of measure, the valuation methods, and the weights are arbitrary resulting in possible large errors. They also mask important changes in the components. On the other hand indicator frameworks are often complicated and technical with unclear guidance on the direction and magnitude of overall developments.

Chapter 3

I attempt to construct an extended time-series for Japan from 1955 to 1995 based on the estimates from three frameworks, the NNW, the SEEA and the NAMEA. The purpose is to observe as to what degree the environmental-economic reality in Japan is reflected in the results. First, the estimates in each system are introduced in detail. Then I try to identify those common points where they can be connected. Both monetary and physical time-series are constructed and presented.

Chapter 4

Chapter 4 is divided into two parts. In the first part I will present the eco-efficiency/eco-intensity trends in the Japanese automobile manufacturing industry for the period 1990-2002. All data were collected at micro (company) level from the environmental and financial reports of 11 companies. Missing data were estimated taking into account the size of the companies (used as weights). Economic performance was measured in three different ways: manufactured units, sales revenue, and gross operating profit. Both manufactured units and sales figures are often used in the automobile industry to measure performance and communicate targets, whereas the gross operating profit is more in line with the core idea of eco-efficiency. Eight environmental areas were chosen for the estimation. This means that more than 20 graphs were constructed to describe the trends. In addition, trends in eco-effectiveness (total environmental burden) will be presented along with the changes in eco-efficiency.

In the second part of Chapter 4 the Sustainable Value Added (SVA) will be calculated for each company. The concept and the indicator are described in Chapter 2. SVA takes account both eco-efficiency and effectiveness and it is built on opportunity costs and eco-efficiency.

Eco-efficiency has been the most influential concept at micro level in the last ten years. Numerous case studies have been made on corporations from all sorts of industrial sectors, but to the author’s knowledge this is the first study that covers nearly all companies in an industry and provides medium term trends. Furthermore, this may

be the first study that effectively utilizes the data in environmental reports for such purposes. Finally, it is important to note that the Japanese automobile manufacturing industry is the second largest in the world, and it is also the second largest industry in Japan; therefore it has substantial economic and environmental impact.

Sustainable Value Added is a newly suggested indicator and few case studies are available. This study has a good chance of being the first one to comprehensively utilize the concept.