IR-3.3 The Research Study to Add the Integrated Environmental and Economic Accounting to the System of National Accounts

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Abstract

The international standards for the System of National Accounts(SNA) were revised in 1993, and as a result, the integrated environmental and economic accounting was included as one of the satellite accounts. In this connection, the United Nations has drawn up a handbook (interim version) to serve as a guide in the preparation of integrated environmental and economic accounting. It has become an urgent task for Japan too, to secure techniques and statistical data for preparing a precise integrated environmental and economic accounting in response to this international trend. Against this background, a three-year project, "The Research Study to Add the Integrated Environmental and Economic Accounting to the System of National Accounts" was implemented from FY1992, in which a concrete investigation was undertaken of the system and structure of the integrated environmental and economic accounting, as well as of indicators and evaluation methods etc. suited to Japan's needs and circumstances.

Based on the results of the past two years and various research studies relating to accounting aimed at the integration of environmental and economic accounts, including the UN Handbook, the FY1994 research involved a concrete investigation of the design of the structure and system of an integrated environmental and economic accounting to be added to the SNA, and of design subjects and estimation methods, the collection, sorting and trial calculation of data, and based on those, a theoretical and corroborative analysis if estimation problems and future research issues, with the objective of drawing out those research results as a report.

In recent times, a fundamental matrix for an integrated environmental and economic accounting based on Version IV.2 of the Satellite System for Integrated Environmental and Economic Accounting (SEEA) was demonstrated in the FY1992 research, and in the FY1993 research, from the aspects of coordination with SNA values and the possibility of data collection etc. this matrix was reviewed. In FY1994, the final matrix structure was established, and definitions of the rows ,columns and the cells items were made.

To data, only qualitative and partial attempts have been made to estimate the magnitude of the integrated environmental and economic accounting in Japan, and this project is the first attempt at a comprehensive research effort. As well as a number of results being obtained from this research, several issues arising in the preparation of the account were brought to light.

Key Words

SNA, satellite account, imputed environmental costs, SEEA,maintenance cost valuation

1. Introduction

With the April 1987 report of the "World Commission on Environment and Development" (Brundtland Commission) and the convening of the Earth Summit (June 1992) as driving factors, and against a background of growing interest in sustainable development, it has become apparent that there is a necessity to comprehend the environment and the economy of each of the world's nations in a single common framework. Further, the UN grasped the opportunity of the revision of the System of National Accounts (SNA) to advance the

development of a matrix for the integrated environmental and economic accounting, and in February 1993, published a handbook (interim version) to serve as a guide for the preparation of such accounts. In the "Agenda 21" of the Earth Summit, it was recommended that each country develop integrated environmental and economic accounting currently under examination at the UN.

2. Research Objective

It has become a pressing issue for Japan too, to secure techniques and statistical data for preparing a precise integrated environmental and economic accounting in response to this international trend. For this purpose, preliminary research was undertaken in FY1991, and from FY1992, a three-year program, "The Research Study to Add the Integrated Environmental and Economic Accounting to the System of National Accounts" was implemented, and a concrete investigation undertaken of the system and structure of the integrated environmental and economic accounting, and of subjects and evaluation methods etc. suited to Japan's needs and circumstances.

Based on the results of the past two years and various research studies relating to accounts aimed at the integration of environmental and economic account, including the UN Handbook, the FY1994 research involved a concrete investigation of the design of the structure and system of an integrated environmental and economic accounting to be added to the Japanese SNA, and of design subjects and estimation methods, the collection, sorting and trial calculation of data, and based on factors, a theoretical and corroborative analysis of estimation problems and future research issues, with the objective of drawing out those research results as a report.

3. Research Method

(1) Establishment of Research Committee

For the purposes of this research, a Research Committee composed six academics and specialists was established. In addition to examining the contents of the research, the Committee undertook a theoretical and corroborative analysis of the trial calculation results, checked the problems and furthermore, examined issues for future research.

(2) Hearing Specialists

Hearings from a wide circle of specialists were conducted for the purposes of this research.

(3) Literature and Research Data Research

Overseas and Japanese literature and research data concerning the system and structure of integrated environmental and economic accounting, and of evaluation methods were collected and analyzed.

(4) Project Team Formation

As a wide spectrum of tasks needed to be undertaken, including the sorting of overseas and Japanese literature, the development of evaluation methods, the collection and analysis of specific reference materials, processing, aggregation, and the development of estimating systems, a Project Team comprising outstanding specialists drawn from various fields was established, which launched into its investigations enthusiastically.

(5) Overseas fact-finding Survey

We visited relevant government institution in Norway and France, in which the preparation of environmental account is relatively well-developed among advanced nations, undertaking a fact-finding survey of how each country tackles the preparation of environmental account, and of their future directions.

4. Content of the Research project

In the FY1994 research, emphasis was placed on activities focusing on the ollowing four points, on the basis of the previous two years of research results.

(1) Establishment of the Overall Matrix Structure

In the FY1992 research, a fundamental matrix for the integrated environmental and economic accounting was demonstrated on the basis of Version IV .2 of the SEEA, and in the FY1993 research, from the aspects of coordination with the SNA values and the possibility of data collection, this matrix was reviewed. In FY1994, this matrix was reviewed again, the final matrix structure was established, and the rows columns and the cells items were defined.

The final matrix structure is as illustrated in Table 1. The major headings which comprise the rows and columns number 11 and 8 respectively, and when sub-headings and the total columns are added in, there are 41 rows and 40 columns. The heavily shaded portions represent non-estimated items, and the lightly shaded regions represent the totals achieved from the results of estimations.

(i) Establishing the Final Matrix Structure

Based upon the problems associated with trial estimation which arose in the FY1993 research, the rows and columns, and the cells which were the subjects of trial estimation were established from the perspective of representing the environmental and economic characteristics of Japan compared with other countries.

(ii) Subjects of Estimation and Estimation Policy

a) Subjects of Estimation

The symbols in various cells of Table 1 have the meanings set out below, with estimations being carried out mainly for those cells with a [circle] symbol.

○ ; Items for which definitions have been made for disaggregation, integration, and estimation techniques, and are the subject of environment-related estimation

△ ; Items which are calculated by deducting environment-related cell value from the SNA figures

☆ ; Items calculated without processing SNA figures

• ; Set at zero, due to difficulties with data acquisition

× ; Not calculated as the concept is clear-cut

◆ ; Carried but not used in the total calculations

b) Estimation Policy for Actual Environmental Costs

In the FY1993 research, estimation were prepared principally on a commodity-based approach, but since the classification of commodities dose not take the environment into consideration, there are limits with that approach, and given the necessity of maintaining coordination between the estimates of imputed environmental costs and actual environmental costs estimates were made with elements such as the environmental data used in the estimation of imputed environmental costs and government environment-related budgets, in addition to the commodity-based approach.

c) Estimation Policy for Imputed Environmental Costs

To improve the precision of various coefficients used in estimating the "Reduction in the quality of natural assets due to waste" for the atmosphere and water etc. which was the subject of the FY1993 research, and make estimates of "Ecosystem destruction " caused by the felling of plantations and land utilization, and the "Depletion of resources " caused by the use of typical energy resources, metallic and non-metallic minerals.

d) Subject Years
The years chosen for estimation to be made were 1985 and 1990, and given the issues of ease of reading the table and coordination with the units represented in annual reports units of ¥100 million are based, to an accuracy of one decimal point. Further, the separate representation of physical quantity data which form the background data used in estimates and the sources and usages are clearly stated.

(2) Methodologies of estimation

(i) For environment-related expenditures that are actually spent, we used the input-output table, budget documents, various statistical and research reports, and industry organization documents to isolate environment, industry, and household sectors from the SNA figures.

(ii) We estimated the imputed environmental cost of natural assets by the maintenance cost valuation method according to the following categories. The maintenance cost valuation method in directly measures qualitative and quantitative changes in the environment by estimating the required cost of maintaining the quality and quantity of the environment at a certain level(e.g.,by estimating the required cost of preventing pollution at source).

a) For air pollution and water pollution, we obtained the imputed environmental cost by first calculating the unit cost of reducing the discharge of each problem-causing substance at the source and then multiplying it by the amount of discharge.

b) For the destruction of the ecosystem caused by land development, the imputed environmental cost was set equal to the loss(i.e., the value-add to be lost)that would be incurred if development were terminated.

c) For the destruction of the ecosystem caused by deforestation, the imputed environmental cost was set equal to the value of production corresponding to the excess felling, when the felling was in excess of the natural growth of trees.

d) The imputed environmental cost of subsoil resources was estimated by the user cost method (i.e., the valuation method based on the concept of sustainability in a broad sense)as the value of investment necessary to maintain the same stream of income after the exhaustion of the resources when part of the profits from the extraction of the subsoil resources when part of the profits from the extraction of the subsoil resources was invested in alternative assets.

(3) A Summary of Trial Estimates

(i) The situation of economic activities and environment-related external diseconomies

a) Actual environment-related expenditures
• GDP was ¥425 trillion in 1990. The environment-related GDP was ¥4.3 trillion in the industry sector, and ¥1.5 trillion in the government sector, for a total of ¥5.8 trillion, or 1.4 percent of GDP.

• On a gross output value basis, environment-related goods and services were ¥6.6 trillion in the industry sector and ¥2.6 trillion in the government sector, for a total of ¥9.2 trillion, or 1.1 percent of total gross output value. In addition, internal environmental protection activities of the industry sector amounted to ¥0.6 trillion.

--gross output value + margins = intermediate consumption + final consumption + final

consumption + capital formation + exports

• ¥4.5 trillion worth of the environment-related goods produced was consumed as intermediate consumption, with ¥3.9 trillion in the industry sector and the remaining ¥0.7 trillion in the government sector.

• Final consumption expenditure of environment-related goods were ¥0.5 trillion in the household sector and ¥1.8 trillion in the government sector, for a total of ¥2.3 trillion, or 0.8 percent of the total (¥279 trillion).

• Environment-related capital formation was ¥0.5 trillion in the industry sector and ¥2.1 trillion the government sector, for a total of ¥2.6 trillion, or 2.0 percent of the total man-made capital formation of ¥134.3 trillion. Net capital formation, exclusive of fixed capital depreciation, was ¥1.6 trillion.

• By adding the above capital formation to the capital stock at the beginning of the period, the environment-related capital stock at the end of the period was ¥23 trillion, or 2.2 percent of the total man-made stock of ¥1,046 trillion, adjusted for price changes during the period. Ninety-eight percent of the environment-related stock was held by the government.

• The stock of cultivating stock was ¥23 trillion, of which ¥20 trillion was artificially planted trees.

• The land stock at the end of the period was ¥2,421 trillion. Of this, developed land was ¥2,031 trillion (83.9 percent), farms and forests ¥381 trillion (15.7 percent), and protected areas ¥10 trillion (0.4 percent). During this year, developed land increased by ¥25 trillion and farms and forests decreased by ¥25 trillion because of a change in the use of land.

b) Imputed environmental cost

• The total imputed environmental cost was ¥8.4 trillion, or 2.0 percent of GDP (2.3 percent of NDP).

• In terms of breakdown by type of natural assets, the cost was ¥6.7 trillion for air pollution, ¥0.2 trillion for water pollution, ¥1.4 trillion for the destruction of the ecosystem (land and forests), and ¥0.2 trillion for the exhaustion of natural resources. In terms of composition, air pollution was 81.0 percent, water pollution 2.3 percent, and the destruction of the ecosystem 16.7 percent, excluding the exhaustion of natural resources.

• Automobiles constituted the principal source of air pollution.

c) Eco-domestic product (EDP)

• By subtracting the imputed environmental cost from net domestic product (NDP), EDP was ¥355 trillion.

-- GDP (statistical discrepancies + fixed capital depreciation + NDP) - imputed environmental cost = EDP

Table-1 New Frame Structure (3/3)

Serial No.	(20)Accumulation & stocks of non-financial assets													Export
	(21)Produced assets						(31)Non-produced assets							
	(22)Man-made assets				(28)Cultivated assets					(35)Land use			Under-ground resource	
	(23)Environment													
	Industry	Govern-ment	Historical properties	Non-environ-ment	Plan-tations	Other	Air	Water	Soil	Develo-pment land	Agricult. Forestry land	Conser-vation regions		
	(24)	(25)	(26)	(27)	(29)	(30)	(32)	(33)	(34)	(36)	(37)	(38)	(39)	(40)
(01)	○	○	◆	○	○	○	×	×	×	○	○	○	○	
(02)														
(03)														
(04)	○	○		×	◆	×	×	×	×	×	×	×	×	○
(05)	×	×		×	·	×	×	×	×	×	×	×	×	·
(06)	×	×		×	·	×	×	×	×	×	×	×	×	·
(07)														
(08)				△	×	○	×	×	×	○	○	○	○	△
(09)														
(10)														
(11)				×	×	×	×	×	×	×	×	×	×	·
(12)				×	×	×	×	×	×	×	×	×	×	·
(13)														
(14)	○	○												
(15)				△	×	○								
(16)														
(17)	×	×		×	×	×	○	○	○	×	×	×	×	·
(18)	×	×		×	○	×	×	×	×	○	○	○	×	·
(19)	×	×		×	×	×	×	×	×	×	×	×	○	·
(20)	×	×		×	×	×	×	×	×	×	×	×	×	·
(21)	×	×		×	×	×	×	×	×	×	×	×	×	×
(22)	×	×		×	○	×	○	○	○	×	○	○	×	×
(23)														×
(24)	◆	◆												×
(25)														
(26)														
(27)														
(28)														
(29)														
(30)														
(31)														
(32)														
(33)														
(34)														
(35)														
(36)	×	×		×	○	×	○	○	○	○	○	○	○	
(37)	×	×		×	○	○	×	×	×	○	○	·	○	
(38)														
(39)	·	·	◆	·	·	·	×	×	×	·	·	·	·	
(40)	○	○	×	○	○	○	×	×	×	○	○	○	○	
(41)	○	○	◆	○	○	○	×	×	×	○	○	○	○	

(Note)

○ Items requiring definitions of disaggregation, integration and estimation techniques

△ Items calculated by deducting environment protection-related cell values

☆ Items which are transferred as non processed SNA figures

· Set at zero, due to difficulties with data acquisition(Note)

× Not calculated as the concept is clear-cut

◆ Carried

■ Items for which the concept doesn't exist

▒ Total value of breakdown

Table-1 New Matrix Structure (1/3)

Serial No.		Value of Production (01)	Import (Including Imp. taxes) (02)	Transport & Trading Margins (03)	Total Supply (demand total) (04)
(01)	Opening stocks				
(02)	Use of products of industries				
(03)	Environmental protection-related goods & services				
(04)	Industry	○	·	○	
(05)	Government	○	·	·	
(06)	Private non-profit organizations to households	·	·	·	
(07)	Non-environment goods & services				
(08)	Industry	△	△	△	
(09)	(Imports of lumber & other forest resources)		◆		
(10)	(Imports of petroleum & other underground resources)		◆		
(11)	Government	△	·	·	
(12)	Private non-profit organizations to households	△	·	·	
(13)	Use of produced assets				
(14)	Fixed capital depletion of environment protection-related assets				
(15)	Fixed capital depletion of non-environmental assets				
(16)	Use of non-produced natural assets(Imported environmental costs)				
(17)	Reduction in quality of natural assets caused by waste		·		
(18)	Destruction of ecosystems		·		
(19)	Depletion of resources		·		
(20)	Effects on the global environment		·		
(21)	Other uses of natural assets(amenity)		×		
(22)	Restoration of non-produced natural assets		×		
(23)	Shift of imputed environmental costs		×		
(24)	(Environmental-related transfer costs)		×		
(25)	Environment-adjusted net domestic production				
(26)	Net domestic production				
(27)	Net indirect taxes				
(28)	Indirect taxes				
(29)	(Deducted) Environment-related subsidies				
(30)	(Deducted) Non-environmental subsidies				
(31)	Employees' income				
(32)	Operating surplus				
(33)	(Deducted) Imputed environmental costs(16+22+23)				
(34)	Value of output				
(35)	Adjustments relating to accumulation of natural assets				
(36)	Adjustments to imputed environmental costs				
(37)	Quantitative changes due to economic factors				
(38)	Other adjustments				
(39)	Quantitative changes not due to economic factors				
(40)	Reevaluations due to market price changes				
(41)	Closing stocks				

(to be continued)

(Note)

○ Items requiring definitions of disaggregation, integration and estimation techniques

△ Items calculated by deducting environment protection-related cell values

☆ Items which are transferred as non processed SNA figures

· Set at zero, due to difficulties with data acquisition

× Not calculated as the concept is clear-cut

◆ Carried

■ Items for which the concept doesn't exist

Total value of breakdown

Table-1 New Frame Structure (2/3)

Serial No.	(05) Productive activity						(15) Final consumption expenditure			
	(06) Industry			(11) Government		Non-profit organization to households	Government	Non-profit organization to households	House-holds	Consumer durables
	(07)Environment		Non-environment	Environmental activity	Non-environment					
	External	Internal								
	(08)	(09)	(10)	(12)	(13)	(14)	(16)	(17)	(18)	(19)
(01)										◆
(02)										
(03)										
(04)	·	·	○	○	○	○	×	×	○	×
(05)	×	×	○	×	○	○	○	×	○	×
(06)	·	·	·	·	·	·	×	·	·	×
(07)										
(08)	○	○	△	○	△	△	×	×	△	◆
(09)										
(10)										
(11)	·	·	△	·	△	△	△	×	△	×
(12)	·	·	△	·	·	·	×	○	○	×
(13)										
(14)	○	○	×	○	×	·				
(15)	·	·	△	·	△	○				·
(16)										
(17)	×	×	○	×	○	○	·	·	○	×
(18)	×	×	○	×	○	○	·	·	○	×
(19)	×	×	○	×	○	○	·	·	○	×
(20)	×	×	·	×	·	·	·	·	·	×
(21)	×	×	×	×	×	×	×	×	×	×
(22)	×	×	×	×	×	×	○	×	×	×
(23)	×	×	○	○	·	·	○	·	○	
(24)	×	×	◆	◆	×	·	×	·	◆	
(25)										
(26)										
(27)										
(28)	○	·	△	○	△	☆				
(29)	○	○	×	×	×	○				
(30)	×	×	△	×	×	△				
(31)	○	○	△	○	△	☆				
(32)	○	·	△							
(33)										
(34)	○	○	△	○	△	☆				
(35)										
(36)										×
(37)										×
(38)										
(39)										·
(40)										◆
(41)										◆

(to be continued)

(Note)

○	Items requiring definitions of disaggregation, integration and estimation techniques	×	Not calculated as the concept is clear-cut
△	Items calculated by deducting environment protection-related cell values	◆	Carried
☆	Items which are transferred as non processed SNA figures	■	Items for which the concept doesn't exist
·	Set at zero, due to difficulties with data acquisition	▒	Total value of breakdown

5. Results of the Research Project

To date, estimates of the integrated environmental and economic accounting in Japan have been restricted to qualitative or partial attempts, and this project is the first attempt at a comprehensive research effort. As well as the following results being obtained from this research, several issues relevant to the preparation of the account were brought to light.

(1) Results

- A basic matrix for the integrated environmental and economic accounting specific to Japan and taking Japanese environmental issues into consideration has been prepared.

- The definition of the rows, columns and cells which comprise the basic matrix have been completed, as have the definitions which indicate the specific content of each cell.

- The types of fundamental data which are needed for estimating actual and imputed environmental costs and their existence or otherwise have been brought to light.

- The positioning of imputed environmental costs and an overview of their numerical order in the gross national product which represents japan's economic activity has been revealed.

- The future directions for continuing research in Japan have been clarified.

(2) Remaining Issues and Future Tasks

(i) Issues and tasks

a) Expanding the scope of estimation

- Other air polluting substances, besides NOx and SOx (e.g., non-methane hydrocarbon, CO, and float particles)

- Other water pollutants, besides BOD and COD (e.g., nitrogen and phosphor)

- Soil pollution, noise and vibration pollution, and the maintenance coat of water resources

- Global warming, destruction of the ozone layer, and other global environmental problems
(e.g., CO_2, fluorocarbon gas, methane gas, nitrogen suboxide).

- The imputed environmental cost of deforestation and others in foreign countries associated with Japanese imports

- The valuation of scenic beauty, plants and animal life, and other amenities

- Positive valuation of environmental assets, including the environmental protection effect of forests and farms

b) improvement of methodologies

The current methodologies are based on many assumptions. It is necessary to reduce the number of assumptions and to raise the overall accuracy of estimates. It is a future task to prepare accounts in which the estimation of the imputed environmental cost is made by a valuation principle other than the maintenance cost valuation method.