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The Green Accounting in Taiwan

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Abstract

The Green Accounting in Taiwan has been officially compiled by the Directorate General of Budget, Accounting & Statistics (DGBAS) of the Executive Yuan in accordance with the basis cited in the UN's System of Integrated Environmental and Economic Accounting (SEEA) in conjunction with Taiwan's certain unique factors. The natural resource depletion refers to profits derived from excessive exploitation of groundwater, gravel and mining resources, while environmental quality degradation refers to maintenance and treatment costs in preventing air, water and waste pollution; all of which are debit entries to Green Accounting, and totaled NT$217.3 billion. What is not yet accounted for, however, are the potential social costs associated, such as harmful pollution toward the human body. The latest year 2000 version of the SEEA compilation method has been adopted by the DGBAS of the Executive Yuan as the trial compilation for this indicate continues.

Keywords : SEEA, degradation, depletion, maintenance cost method, EDP, Green GNP

1. Prologue

Agenda 21, the Rio Declaration on Environment and Development adopted during the UN' s Global Summit held in Rio de Janeiro in June 1992 by the Commission for Sustainable Development of the United Nation which lead to the signing of The Convention on Biological Diversity and United Nations Framework Convention on Climate Change as the action guideline in promoting sustainable development by countries across the globe, where the pursuit of a sustainable development has risen to become a leading direction for the global communities. Looking to the 21st Century, a reflection of the overall environmental quality has become a vital indicator for measuring the nation's competitiveness. And as dictated by Agenda 21, under which Taiwan is in full support of promoting the universal vision derived from the Commission for Sustainable Development of the UN, the mission lies in achieving an equilibrium between ecological reservation and social and economic development with the effective use of natural resources in the new millennium. It is with high anticipation that all future generation may enjoy a sustainable ecology, safe society, and open economy, and beneath all this compilation of a reliable Green

Accounting has risen to become a vital instrument that can correctly reflect the state of the environment and economy.

Despite being a popular instrument for measuring a country's economic achievements, the GNP may fall short of accurately assessing the real welfare of the general public in a country since none of the environmental pollution and depletion of natural resources are included in such a measure. In view of such, the United Nations began studying Green GNP more than a decade ago as a reliable means to measure living standards, levels of welfare, and ecological equilibrium. It also serves as an indicator of environmental development by deducting the depletion of natural resources and degradation of environmental quality from GNP in search of a level of sustainable development for a nation's economy. In recent years, the compilation of Green GNP has steadily gained importance among developed counties, including the United States, Germany, Canada, Japan, and the Netherlands while emerging developing countries such as the Philippines, Mexico, Indonesia, India, Thailand, South Korea and Mainland China have taken pilot runs under the System of Integrated Environmental and Economic Accounting (SEEA) led by the United Nations and the World Bank. An important characteristic of SEEA is to connect with traditional system of National Accounting to measure and reflect the real economic and environmental development in a country.

2.Origins

Since the 1950', Taiwan's economy has undergone swift changes. By the concerted efforts of the government and its people, the country has created world-acclaimed "economic miracle". With the expansion of production scale and rapidly growing population, however, the depletion of resources and numerous pollution problems became deteriorating day by day. Because the damage done to the ecosystem often cannot be repaired and can result in enormous social costs, in 1997, the government placed an emphasis on the development of economic and science technology by promulgating an amendment to Article 10 of the ROC Constitution to support environmental and ecological protection. To make this policy a reality, the Executive Yuan's Environmental Protection Administration (EPA) has since April 1998 invited pertinent agencies to ad hoc meetings, reaching the conclusion of short-term, mid-term and long-term policy implementation. The EPA was given responsibility for compiling an Index for Sustainable Economic Welfare (ISEW), which served as a reference for developing Taiwan's Green Accounting. This index will complete the short-term stage of the policy implementation. The mid-term mission states that the Executive Yuan's Council for Economic Development should coordinate with pertinent departments to set up a database for Green Accounting, with which sorting and test runs can be prepared. As the Green Accounting figures are released by leading countries around the world, the Executive Yuan's Directorate General of Budget, Accounting & Statistics will be in charge of compiling Taiwan's Green GDP Accounting before the information is made public. Nevertheless, Article 29 of the Budget Act amended on October 1998 stipulated that the Executive Yuan is to complete the test run on Green GDP Accounting, giving greater impetus to DGBAS actively pursuing a test-run.

Since there is no standard Green Accounting practice, we cautiously compared the pros and cons of all available system (See Table 1) and finally decided to adopt U.N.'s SEEA framework as a basis for developing Taiwan's Green Accounting in terms of its scope of compilation, major contents and required data. An initial all-out effort has been made to collect data by studying the latest international theories and studies and soliciting input from environmental and economic scholars. Several departmental coordination meetings were held in conjunction with opinion polls provided courtesy of U.N. expert Dr. Joy E. Hecht, supported by house committee meetings and panel discussions with renowned local environmental protection scholars, in addition to a broad-based opinion poll for gathering input. This study discloses the preliminary study results, which not only propose a tangible way to conduct the test run, but also bring forth a comprehensive overview of Taiwan's environmental indicators and environmentally adjusted Green GNP between 1996 and 1998, showcasing Taiwan's environmental degradation and depletion of natural resources.

3. Method

Currently the U.N.'s SEEA framework has been adopted for compiling Taiwan's Green Accounting, and the keys behind such a system lie below,

(1). The system, introduced by the UN and the World Bank and cosponsored by the OECD and EUROSTAT, is supported by four major international organizations, with environmental specialists from 15 countries participating in addition to the London Group on Environmental Accounting that dedicates itself to providing authoritative opinions.

(2). With the U.N. actively promoting the system, it has been widely adopted by more than 20 countries including the United States, Japan, Korea, and Canada. SEEA is regarded as the most popularly adopted working system from the host of existing environmental accounting systems to date.

(3). The system measures the depletion of natural resources and environmental degradation in monetary terms, which provides a consistent measure indicating environmental changes in language more easily understandable to local residents.

(4). The system comes with a complete test-run manual released in 1993 and an operations manual published in 1998. Both allow a clear-cut path to data compilation. Despite certain controversies that remain in calculating social costs since no viable means can be used to determine whether such losses are the result of resource depletion or environmental degradation from the current period or from earlier periods. (Refer to Integrated Environmental and Economic Accounting - An Operational Manual, 1999, pp 00 11, 13, 17, 21, 27, 31, 43, 45, 72, 80-84, 96.) As a result, none of these data have been included before a consensus is reached .

(5). A quick recap finds room for improvement and enhancement to the current database of Taiwan's environmental statistics in terms of the accuracy, timeliness, and the coverage of data entries and quality. Given the lack of a good database and related academic studies, it may be too early to initiate a test run of the SEEA framework in Taiwan. However, the experience of Japan is worth emulating. Using the SEEA framework, Japan continues to gather pertinent data and has since 1991 completed the third phase of its test-run project covering fiscal 1998 to 2000. Their experience shows that the meticulous development of a complete accounting system is the way to compile environmental data that mirrors a realistic picture of the GNP.

In summary, the adaptation of first stage of the SEEA system for compiling Green GNP is shown on Table 2. As the SEEA continues to evolve, the DGBAS aims to continue strengthening the test findings based on the current framework in conjunction with core advantages provided by other systems.

Based on the UN's SEEA system, the key objectives behind Taiwan's Green Accounting project lie in focusing on the potential impact of the depletion of natural resources and environmental degradation. Estimation for the depletion of natural resources has been taken by the net price method, meaning exploitive gain minus exploitive cost. While estimation for environmental degradation has been taken by the maintenance cost method, which means the act of pollution without any preventive measures is applied in order to estimate the required cost of pollution prevention in conjunction with the use of the best available technology as a viable means to estimate the degradation of environmental quality. Indirect pollution factors - which may be difficult to put in a quantifiable measure and remain controversial - are excluded, such as costs borne to human health and cost valuations of natural resources. A diagram indicating the process of compilation is provided on Figure 1. The description and findings on the detailed tabulation of the depletion of natural resources and environmental degradation are to follow separately in parts five and six.

4. Taiwan environmental statistics indicators

Crucial tasks for Green Accounting began with a thorough collecting of environmentally related statistics, and the subsequent establishment of a complete database on environmental protection indicators, which are vital for observing the changing trends in environmental ecology over time. Working along the framework of national environmental indicators outlined by the SEEA, OECD, and widely adopted by major countries around the world, the administration sets out to establish a set of Taiwanese environmental indicators. These are subdivided into six major categories including atmospheric environment, aquatic environmental, terrestrial environment, ecological environment, human environment and miscellaneous environmental protection behaviors, consisting of 16 intermittent categories broken down into 109 statistical indicators. (See Table 3)

Besides citing the various pollution indictors provided by the above mentioned environmental indicator database, the actual compilation of Green GNP also requires converting such quantitative indicators into monetary rated indicators for environmental degradation. In terms of the depletion of natural resources, so far only seven categories: groundwater, crude oil, natural gas, coal, gravel, marble, and limestone, have been accounted for in monetary terms. Meanwhile, environmental degradation consists of water quality, air, and waste pollution. Factors such as over-fishing, illegal exploitation of coral reefs, excessive land development, stratum sink, noise pollution, soil pollution, greenhouse effects as well as ozone depletion have not been included in this compilation for Taiwan's Green Accounting due to the lack of comprehensive data, which will be further developed. Yet certain quantifiable indicators have been included in Taiwan's statistical database. For example: areas recording a noise level higher than 65 decibels, reported complaints of noise hazards, funding for monitoring noise and vibrations classified under noise pollution, and two indictors including the area of sink and rate of sink have been classified under the stratum sink category. The fluctuations of such quantifiable indicators can also be the basis for evaluating environmental degradation, anticipating that further integration from the academic sector, coupled with mirroring the experiences of other countries to continue perfecting the system for documenting a comprehensive system of Green Accounting.

5. Taiwan's natural resources depletion

The depletion of Taiwan's natural resources include the depletion of groundwater, gravel, natural gas, coal, and crude oil as determined by the net price method, but does not include over-fishing, coral reef exploitation and the soil erosion caused by over-development. The compiled results are shown on Figure 2 and Table 4. Meanwhile, the volumes of chopped wood have been decreased in recent year and sizes of forestry increased gradually resulted from an effort by the government's policy to forbid chopping from 1992 and aggressively develop forestry conservation. The total size of forestry reached 21,017 Km^2 in 1998 and occupied 58.4% of land in Taiwan, which is higher than that of 51.8% in 1995. Therefore, the estimation of natural forestry depletion is not included either.

The results of this estimation show that ground water was decreased to 5.94 billion tons in 1998 due to water extraction. The depletion of ground water was reduced from NT$ 20.13 billion of 1996 to NT$ 12.76 billion of 1998. The decreasing rate is about 40 percent. It shows that the rate of depletion has slowed. The mineral resources consumed NT$ 7.14 billion; increased NT$ 3.72 billion or 110% compared with 1996. The percentage in NDP increased from 0.05 percent to 0.09 percent; of which the gravel depletion is as high as NT$ 5.06 billion (70.9 percent), the second highest is the depletion of natural gas of NT$ 1.68 billion, totaling 23.5 percent. (See Figure 2)

6. Taiwan's environmental quality degradation

The estimation of Taiwan's environmental degradation has been derived from the SEEA system, a method also adopted by Japan and South Korea. This system offers a realistic method of calculating environmental degradation resulting from pollution by multiplying the unit cost of pollution prevention by the volume of discharge. This means that the act of pollution without taking any pollution preventive measures is applied for estimating the due cost of pollution prevention cost for curtailing such pollution without taking into account indirect pollution impacts that cannot be expressed in a quantifiable term or remain controversial, such as the costs borne to human health. In the absence of the cost data related to the preferred technique, historic cost data can be substituted. Currently, the administration only accounts for water, air, and waste pollution in calculating environmental degradation, while noise pollutionand and other forms of pollution, are temporarily left out since most countries have not taken into account such categories. A comprehensive account of the estimation of degradation due to air, water, and waste pollution can be found on Table 5-7.

The findings from the estimation indicate that in terms of air pollution, the number of automobiles and motorcycles that are continually rising, coupled with rapid industrial and commercial developments, have increased air pollutants. To improve air quality, the government has been actively increasing the budget with the introduction of an air pollution prevention fund in addition to an all-out promotion of fixed pollution control, construction project inspection as well as exhaust checks on automobiles and motorcycles. A glimpse of related indicator readings show that such preliminary actions are bearing fruit as the number of days in which the PSI ratings exceed 100 has steadily dropped from 6.1 percent in 1996 to 4.6 percent in 1998. While estimation of air pollution for 1998 at $48.64 billion, accounted for 0.59 percent of the NDP, down by 0.15 percentage point than $52.09 billion, or 0.74 percent, recorded in 1996.

In regard to water pollution, industrial and residential discharges in addition to waste from livestock are the major sources of water pollutants. To alleviate the pollution from discharges by the industrial and livestock sectors, the government has tightened its monitoring program over business wastewater pollution. The foot-and-mouth disease in Taiwan that out broke in March 1997, the ratings on river systems where severe pollution can be detected by length declined to 12.6 percent and daily discharge weighed 1,620 tons, boasting historic lows for the past three years, a sign that total water pollution has declined. Yet, since nearly half of the total discharge came from residential discharge, the prevalence of a working sewage system plays a vital role in determining whether factual improvements have been achieved by this sector. Hence, the government has since 1997 stepped up its efforts in expanding the underground drainage, improving the rate of prevalence in order to tackle processing residential discharge for the ultimate good of improving the health, hygiene, and standard of living for all residents across the island. Preliminary estimation pegs environmental degradation by pollution in fiscal 1998 at $2.14 billion in agriculture, $21.65 billion in industry, $57.78 billion by municipalities, totaling $81.57 billion, or 1.0 percent of the NDP, down by 0.11 percentage point than $78.11 billion, or 1.11 percent, recorded in 1996.

In regard to solid waste pollution, a steadily increasing population and booming economic activities have increased garbage output in Taiwan. Coupled with surging public awareness toward environmental protection, garbage disposal problems are increasingly becoming an issue that the government must deal with. In view of this , the government has stepped up efforts in refuse removal, combining an all-out effort in developing and manning dumpsites and incinerator plants. The spending on solid waste prevention in the past three years have tapped $60 billion dollars in each fiscal budget, allowing the rate of proper disposal of household waste to improve from 70.9 percent in 1996 to 82.9 percent in 1998. Through reduction and recycling, proper disposal of business waste excelled greatly from 44.8 percent in 1996 to 65.8 percent in 1998. It is estimated that environmental degradation by waste pollution has dropped from $84.54 billion in 1996 to $67.16 billion in 1998, down by 20.6 percent, bringing the ratings against the NDP from 1.2 percent down to 0.82 percent, a drop of 0.38 percentage points.

Meanwhile, an environmentally adjusted Green GNP for Taiwan and an integrated environmental and economic accounting for Taiwan in 1998 based on the SEEA framework in conjunction with the data described earlier are shown on Table 8 and 9. Environmental degradation by various pollutants throughout Taiwan in 1998 totaled $197.37 billion, or $217.27 billion if the depletion of natural resources is taken into account, down by 8.8 percent compared to the 1996 figure of $238.28 billion, or 2.65 percent against the NDP, also down by 0.74 percentage point than 3.39 percent recorded in 1996. It is a small comfort to know that both the depletion of natural resources and degradation of environmental quality have calmed down slightly thanks to increased public awareness about environmental protection as well as the active efforts by the government. For comparison, a list of the ratings of the depletion of natural resources and environmental degradation against the NDP in other major countries is provided on Table 10 and Figure 4. The most recent ratings indicating Japan at 1.15 percent (1995), South Korea at 2.63 percent (1992), the United States at 8.25 percent (1987), and Mexico at 13.34 percent (1985). The figures are intended as references since no countries are exactly alike in terms of specific condition, natural resources, completeness of data, or range of statistics included.

What remains noteworthy is that not only do none of the figures for depletion and degradation provided above consist of any losses in social costs, but Taiwan's combined rating of 2.65 percent against NDP (1998) is higher than 1.15% of neighboring Japan and 2.63% of South Korea with similar backgrounds using the same SEEA system. This implies that the levels of waste and water pollution, illegal quarrying, and groundwater pumping remain excessive, setting off a warning that there is plenty of room for improvement despite the long way Taiwan has come in the area of environmental protection.

7. Forecast in the Future

Since the framework of SEEA included various satellite accounting, the DGBAS have

finished the estimation of environmental depletion and degradation and maintaining cost for each pollutants, which only occupied 20 -30 percent of SEEA because of the limited information sources and preparation methods at present. Thus, there shall be still great space for future development. The preliminary results show that the depletion of natural resources and degradation of environmental quality were NT$ 217.27 billion in Taiwan in 1998, which occupied 2.65 percent of NDP. It is lower when compared with 2.91 percent in 1997 and 3.39 percent in 1996. Because of the abundant information covered by the Green Accounting, we could not explain the overall environmental economic change only by a single number. We should observe the other numbers and relevant background for the account so that we can have a complete understanding of the environment in which we live. Take the natural resources depletion and environmental quality loss of NT$ 217.27 billion in Taiwan in 1998 as an example. The loss in water quality pollution is as high as NT$ 81.57 billion (about 37.5 percent). It is the biggest loss among all natural resources and pollution resources, of which the city wastewater is the biggest loss of NT$ 57.78 billion. This is mainly because that the popularization rate of wastewater sewage is only 7 percent. It is not only far behind 90 percent of Europe and America, but is also lower than 50 percent of Japan and 45 percent of South Korea. It shows the importance and urgency of constructing water sewage treatment facilities in Taiwan. In the aspect of solid waste pollution, the industry waste occupied 80 percent (NT$53.74 billion) of total waste pollution mainly because the treatment of recycled waste is not satisfactory. It could be improved if we speed up the establishment of waste treatment facilities and improve the system for handling waste.

In the future, we will collect basic data to improve the data quality, and the latest theoretical developments to take into the Green Accounting process in Taiwan. These works have to be done together with related environmental organizations. Besides communicating with advanced countries with practice and experience, enhancing communication and cooperation with academia is also necessary. We will furthermore combine all efforts under the current basis to forge ahead.

To ensure a thorough review of Green Accounting, a few developmental focuses for future review have been outlined and elaborated below,

(1). Review the Scope of Compilation

A. To Expand the Range of Categorical Statistical Accounting

In an effort to avoid repetitive calculation and in consideration of allowing a comprehensive coverage of all data without conflicting with each other, pending panel discussions have been scheduled to invite related departments, academics and experts to examine and define a range of environmental protection expenditures to be accounted for. Also bound by the limitation of data sources and the lack of subjective criteria for evaluation and assessment, the estimation on certain categories of environmental degradation, such as noise, ground sink, exploitative fishery, soil loss, ozone depletion and greenhouse effects are temporarily not to be included, pending further assessment and reference to global accounting to gradually expand the range of accounting.

B. To Strengthen Satellite Accounting

The UN's SEEA framework consisting of environmental protection expenditures, monetary produced natural assets accounting, physical and monetary and physical account for non-produced economic asset, amount of emission and cost of pollution account by industries and environmentally-adjusted Green Accounting in a series of more than 10 accountings. Yet the absence of some original data has been limited , the DGBAS only has compiled the integrated environmental economic accounting and environmentally-adjusted Green Accounting so far. While the future will call for steady steps to expand various related accountings by pollution types and by departments, i.e. household, private industry and government sectors in conjunction with the states and methods taken globally to truly reflect a comprehensive Green Accounting.

(2). Strengthening Pertinent Data Essential To the Current Accounting Tasks

A. The Absence of Primary Data Source

So far two the major sources of pollution protection expenditure are stemmed from "the Government Agency Environmental Protection Expense Surveys" by the Environmental Protection Administration and the "Industry Statistical Surveys" by Ministry of Economic Affairs. Some of the pooled data that cannot be segregated by pollution sources, coupled with inconsistent categorization resulting in time gaps, will need to be improved upon as far as both types of survey studies are concerned for the purpose of increasing the data reliability.

B. To Develop A Comprehensive Database

In view that some of the fundamental data have not been routinely gathered and the lack of historical continuity, it has been proposed to verify the definition and range of data first for improving the quality and completeness of data before such task may be forwarded to pertinent agencies for routine gathering and filing with the DGBAS of the Executive Yuan as a viable mean to gradually develop a comprehensive fundamental database.

C. To Improve Database by Industry

Being that the current data on pollution sources by industry gathered have been that of a one-time survey or of an incomplete nature, efforts are to continue in building up pertinent data by industry to offer more reliable data on environmental degradation by industry to offer references to government administration.

D. To Strengthen Integrated Environmental And Economic Accounting

For a complete integrated environmental and economic accounting ought to encompass productivity and cost structure on all output related to environmental protection, but the lack of reliable data has kept them from being included in the accounting at the present stage. Efforts will continue in the future to build up pertinent data to allow a more comprehensive work of integrated environmental and economic correlated accounting

E. To Broaden Collecting Environmental Protection Laws And Regulations And The Data On Funding Appropriation

In an effort to precisely monitor the results of the government's policy promotion and to

define the correlation of changes among various types of environmental degradation, efforts for collecting pertinent data on governmental environment protection policy, laws, implementing schedule and related funding appropriation are to continue.

F. To Collect Related Global Data

Bound by varied conditions from nation to nation and diverse natural resources, to allow more complete global comparison data to support the rationale behind the results of Taiwan's accounting, efforts will continue in assembling the range, method, background information and trends in order to improve international comparisons.

(3). Overview On The State Of Pollution Source Accounting And Direction Of Future Improvements

A. Air Pollution

(a) Data on pollution prevention expenditure, that for private agricultural sector, construction and service industries have been estimated by statistical methods, which will require further collecting in the future.

(b) In calculating the average unit cost, that for mobile source only includes some of the cost for promoting various control measures, such as the execution and administrative fees, gas station launching subsidy, vehicular update subsidy, etc., none of the administrative cost or manpower cost at the Bureau of Industries, the Energy Council, or Bureau of Standard Measurements of MOEA have been included as part of the range of calculation. While in the area of stationery source, so far only the investment on preventive equipment, operational maintenance fees and air pollution fees are taken into account, but none from process improvement, fuel cost, secondary pollution disposal, government sponsored prevention funding among other expenditures were included as part of the range of calculation.

(c) In estimating the data on discharge volume, the historical data on figures of discharge volume, or the output, has been based on the discharge volume of expectant growth, meaning that future discharge volume has been derived from the state of the based year where the monitoring is introduced. As a result, the current volume of reduction has been based on the reduction volume derived from the state of monitoring at the based year, but without separately estimating the respective discharge volume of pollutants on mobile sources versus stationery sources, which may not be as rational . In the future, the actual state of promotion through each fiscal policy promotion in conjunction with pertinent data will be updated yearly.

B. Water Pollution

(a) In the area of pollution prevention expenditure data, the present information on private-run agricultural sector, construction and service industries have been estimated by statistical methods. Also data on residential discharge processing equipment, sewage, and septic tank at aggregated residential communities is missing, too. These data will be a focus to widely collect in the future.

(b) In calculating the unit cost, data on municipal residential discharge and agricultural discharge, hindered by the lack of a best available technique for pertinent processing cost data, are estimated from the history data derived from investment on water pollution prevention equipment and related operations maintenance cost, which is the so-called history cost approach that Japan has adopted as well. While the industrial discharge has been estimated based on the best available techniques of wastewater processing site development costs in industrial zones for deducing the unit cost on pollution prevention equipment, and the operations maintenance cost is estimated from historical cost approach. However, the one-time research report that lacks time-chronicled data, will call for locating a best available technique to calculate the unit cost on agricultural discharge, municipal discharge and routine categorized industrial discharge to best meet the accounting principle behind pollution degradation.

(c) As far as the volume of reduction on municipal discharge, the processing efficiency on building discharge processing facilities remains underrated to the comprehensive public wastewater and sewage system including the collecting and processing subsystems. Similarly, the cost of investment in prevention does not necessary equate to an equal amount of pollution reduction derived for the current estimations have not been separately estimated from the individual processing efficiency. Therefore, it is imperative to collect data on the efficiency of processing wastewater by building wastewater-processing facilities.

(d) Although the volume of production, emission and discharge of wastewater being the basis essential for calculating the pollution degradation, the ambiguity and the absence of further clarification on original data, coupled with the odd phenomenon that some historical data on output could actually be identical, are elements that need to be improved upon by launching a comprehensive data generation and estimation mode with clear description given to explain how data are generated to alleviate outside concern and to improve the accuracy of data concluded.

(e) The calculation of the unit cost on municipal discharge by historical cost approach entails taking 80% of government's prevention cost on equipment, including the sewage systems, and maintenance expenditure, and the other 20% based on the cost or processing industrial discharge since the wastewater sewage does not exactly process just the municipal discharge but also some industrial discharge. And before an optimal technique for the unit processing cost can be located, it is imperative to strengthen data collection on a wastewater processing plant by source so as to improve the accuracy of pollution degradation by category and by industry.

(f) For lack of complete estimation data on pollution degradation by industry such as municipal wastewater spending by category should have been divided into three parts, i.e. by the government, households and service industry, currently the portion on government and service industry has been taken from ratio of pollution discharge by enlisted businesses against pollution discharge volume by total enlisted businesses before applying the proportion of pollution degradation on public service industry among other service industry against the government and

service industry categories, while the degradation by household category is derived from deducting the sum of the above two category from the total municipal degradation. In terms of shares by industry category, it is based on the total volume of wastewater BOD declared by category on enlisted businesses reported to the Bureau of Water Resource Conservation of the Environmental Protection Administration against the total industrial discharge reported, which is regarded as lacking comprehensiveness. The future will call for stepping up collecting data on the volume of wastewater discharge by category and industry.

C. Solid Waste Pollution

(a) In terms of funding data on pollution prevention, that for the private construction industry and service industry has been estimated by statistical methods at the present time, and the future will focus on collecting data concerning funding appropriated on pollution prevention.

(b) For lack of data on unit cost for a best available technique for concluding pertinent data on unit processing cost of waste generated, the current average waste processing cost has been estimated based on the amount of waste pollution degradation by historical cost approach. Government expenditure has not been segregated to reflect whether it is for processing agricultural waste, industrial waste or general waste. Consultation with experts and academics suggested that the division is to be 10% on agricultural waste, 20% on industrial waste and 70% on general waste; however, there is still a need for tangible and reliable research data that can be referred to, thus the future efforts will focus on the collection of reliable data in order to define a more rational method of estimation.

(c) In the area of data on the volume of production, emission and reduction, so far there has not been pertinent data on medical waste, construction waste, recycling or reprocessing waste. Also data on the refuse derived from incinerator processing has not been broken down into statistical data by category, such as by industrial, agricultural or household sectors, which will also call for stepping up collecting pertinent data to further perfect the results of accounting.

(d) For lack of comprehensive estimation data on pollution degradation by industry, such as the amount of degradation by industrial waste output divided by specific trade, the division has been taken from the SIC two-digit codes including the total business waste output enlisted in the "Environmental Update" released by EPA in 1997, which were the framework based on census data in 1990. As to the general waste by category, i.e. household, government and service trade, rounds of panel discussion concluded that the weighted distribution will be 50% on household discharge, and the rest on the government and service trade will be estimated from the number of employees. This has been critical for lacking comprehensiveness, and the future will call for a further collection of data of business waste by trade as well as specific data on the output of general waste by household, government and service trade, in order to establish a more rational method of estimation.

(e) Noteworthy is that some of the unscrupulous business waste processing operators have been found to engage in illegal disposal once the waste is collected in order to cut processing costs amid

fiercely negative competition of price cuts. Limited by the current data which are derived from the operating revenues at the private processing trade concluded from business census poll in conjunction with the secured business waste processing volume from the Environment Protection Administration, the current method will have to be used despite the fact that there is warped information contained within before a more reliable method adopted. The future will improve collecting pertinent information so as to allow illegal disposal volume processed by business waste processing services from the adequate amount, or reconciled into a rational processing service cost.

(f) Not only have a variety of government exemptions not been correctly accounted for - such as exemptions for purchasing pollution prevention equipment, resources recycling equipment, environmental protection equipment or deductibles to investment in technology - but the costs of acquiring the land for incineration plants and burial sites have not been accounted for either. This area should eventually refer to methods by other advanced states to strengthen collecting related data for a reliable estimation.

From this we could see that we shouldn't use a single number (such as the rate of natural resource depletion and environmental quality degradation over NDP or Green GNP) to represent the overall environmental change. It is the same that the traditional national income account could not represent the overall economical growth (different explanation for different economical development phase, the different economical growth). It should be expressed by the complete Green Accounting for the environmental and economic status. More important, the figures on natural resource depletion and environmental degradation expressed in Green Accounting are merely representing negative environmental impacts rising from the economic developments achieved at the time and converted to a nominal result. However, the inaction to take measures to curtail any depletion or degradation will only prolong the negative environmental impacts as they accumulate, thus it is unfair to draw any conclusive results merely on a single year's figures but rather merits on a continued surveillance of historical data on Green Accounting and environmental changing trends. Currently, the DGBAS of the Executive Yuan are studying the latest 2000 SEEA version to aggressively complete the unfinished parts in the SEEA framework, particularly those concerning the social costs associated with natural resource depletion and environmental degradation. In the future, we should actively improve the data quality . We should have our data correctly reflect the status of the environment to serve as a basis for government decision making to make Taiwan become the Green Silicon Islands both economically and environmentally.

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