Development of a Local Environmental Sustainability Index in Taiwan

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Introduction (I)

- 1987: The definition of sustainable development (SD) was announced in "Our Common Future".
- 1992: SD was planned to be implemented via Agenda 21 in the 1st World Summit
- 1996: The UN City Summit held in Turkey lunched the four goals as health, safety, equity, and sustainability for realizing the concept of "think globally, act locally".
- 2002: Rio+10 declared that local sustainability is one of the most important issues
- Sustainable development indicators (SDI's) is the one used most widely among all of the sustainability assessment tools. Many SDI's were designed for cities.

Introduction (II)

- The status of "sustainable development" in Taiwan has shifted from concept promotion to practice through research and policy implementation.

- The national scale projects sponsored by NSC, CEPD, and RDEC for sustainable development from 1997 to 2003 severe as the base for following long-term sustainable development research works.

- The Sustainable Development Council of the Executive Yuan has been using "Sustainable Taiwan Index System" to evaluate and announce the status of the country every year.

- In the international society, many research projects regarding "sustainable development indicator" or "sustainability indicator" have also been carried out. Their impacts to human development are increasing.

Introduction (III)

- Take the ESI (Environmental Sustainability Index) as an example, its leading position in this field has been confirmed through successive scoring and ranking over 100 countries from 1999 to 2002. The results actually influenced the administrative priorities of some countries, e.g., South Korea, Norway, Mexico.

- In 2005, Taiwan was included in the country list for the first time. However, Taiwan got a rank of 145 in 146 countries. This result attracted the country's attention. The government then accepted the ESI as an official national scale sustainability appraisal index system. The Science Consultants' Office of EPA serves as the front door for communicating the ESI team.

- Thus, according to the fact that SDI's and local sustainability are becoming more and more important and half of the counties in Taiwan have had lunched some initiatives, development of an SDI for counties that is anticipatory, policy-oriented, and widely accepted is meanful.

Sustainable Development Indicators (I)

- Application of SDI for the first time: Human Development Index (HDI), which included
  - Life expectancy index
  - Education Index
  - GDP Index
- In 1995, the UNCSD initiated a SDI project and then announced a "Framework of Sustainable Development Indicators" based on Agenda 21.
- Four aspects, social, economic, environmental, and institutional, are included in this framework. In another dimension, the indicators can be categorized as "driving force", "state", or "response". There were totally 134 indicators. 22 countries participated in the pioneer testing projects.

Sustainable Development Indicators (II) the ESI

- Team member:
  - Global Leaders for Tomorrow (GLT) under World Economic Forum, WEF
  - the Yale Center for Environmental Law and Policy (YCELP)
  - Columbia University Center for International Earth Science Information Network (CIESIN)
  - Joint Research Centre, European Commission in 2005
- Historical development:
  - A Pilot ESI was announced in 2000; 2001 ESI and 2002 ESI were then announced in 2001 and 2002.
  - Totally 56, 122, and 142 countries were ranked in 2000, 2001, and 2002, respectively. Taiwan was not included in these three years.
  - Taiwan was included in 2005 ESI with a rank as 145/146.

Sustainable Development Indicators (II) the goal of ESI

- The ESI enables (2002 ESI report, WEF)
  - identification of issues where national performance is above or below expectations
  - priority-setting among policy areas within countries and regions
  - tracking of environmental trends
  - quantitative assessment of the success of policies and programs
  - investigation into interactions between environmental and economic performance, and into the factors that influence environmental sustainability

Case studies of local SDI's (I)

- 1993: Sustainable Seattle, covers four aspects as environment, human population and resources, economy, and culture. There were totally 40 indicators.

- 2002: Bristol, UK, Development of Quality of Life in Bristol, covers "environment", "ecology", and "society".

- The Selangor in Malaysia developed a SDI containing 30 indicators in the components of economy, environment, natural resources, and society.

- Shanghai, China developed a SDI containing 13 issues and 28 indicators in the categories of "environment and resources", "economic development", and "society".

- Shandong Province, China employed 22 indicators and 43 variables in 2002 ESI to evaluate its sustainable development status.

Case studies of local SDI's (II)

- From 1997 to 2002, the Sustainable Development Index System for Taiwan was developed with the support of NSC using the PSR framework. This "Evaluation System for Sustainable Taiwan" has two parts: "Island Taiwan" has 18 components and 83 indicators; "Urban Taiwan" has 29 indicators.

- This system was further refined with the support of CEPD and RDEC. It was renamed as "Taiwan's Sustainable Development Index System" and the numbers of indicators for "Island Taiwan" and "Urban Taiwan" were reduced to 34 and 8, respectively.

- Huang (1996) developed a "Taipei Sustainable Development Index" using the ecological economic system model.

- In the local sustainability projects supported by CEPD in 2004, visions and indicators for Taipei, Taichung, and KKP (Kaohsiung City, Kaohsiung County, and Pingtung County) were develped.

Research Goals

Goals

- Developing and constructing a "Local Environmental Sustainability Index of Taiwan" (LESIT) in the scale of county/city.

- With the aid of LESIT, the scores and ranks of the 25 counties/cities in Taiwan can be obtained through investigating the database.

- An "Environmental Quality Appraisal" institution can be set through LESIT.

- Urge the counties/cities to propose an "Environment White Pages" and then examining the performance year by year.

Research Approaches

Approaches and steps

- Examining the international and domestic literature including ESI, "Taiwan's Sustainable Development Evaluation Index", and other SDI's and drafted the LESIT.

- Forming an ad-doc committee and through several intensive brainstorms, developing the LESIT that is future trend oriented.

- Determining the items and evaluation steps of county level Environmental White Pages with considering the socio-economic and natural characteristics.

- Using Taipei County as the first case study and then promoting the LESIT to other counties.

Ad-hoc meeting (I)

- September, 2006, for confirming the goals, issues, and promotion steps.

- Elements to be considered:
    - Generality and linkage to the international trend
    - Statistical bases
    - Operatable in the framework of local governments
    - Locally specified items

Ad-hoc meeting (II)

- An off-site meeting was held in mid October, 2006 for intensive brainstorming. The vision, essence, and main issues to be considered for the LESIT were discussed in the 2-day meeting.

- Guiding principles of the indicators:
  - Academic severeness
  - anticipatoriness
  - Policy-oriented
  - operatability
  - flexibility

- Issues discussed
  - The central thinking of the LESIT
  - The basic framework and components/aspects
  - Key indicators
  - Quantification and computation

Members of the ad-hoc committee

- Lee, J-D
- Liaw, S-L
- Yu, Y-H
- Kao, C-C
- Zhan, H-S
- Lo, S-L
- Hsiao, D-G
- Den, C-C
- Kan, S-F
- Yeh, S-C

- Tung, C-P
- Liou, M-L
- Zho, L
- Wang, H-Y

Ad-hoc meeting (III)

- The 3rd and 4th ad-hoc meetings were held on November, 2006 for discussing the framework and indicators.

- The principles suggested by the committee:
  - Systematic thinking
  - Linkage to the international trend; core indicators as well as specified indicators should be considered separately;
  - Can be announced by CTCI Foundation and other public media;
  - Opinions of the local government should be included;
  - The number of indicators should not be big but every indicator should be determined through severe approaches
  - Think of the indicators positively and at the same time concern the possibility of becoming just showing off
  - Just determining the framework at this stage
  - Take the "common divisor" of all local governments

Results

Determination of the framework (I)

- Select one in the following potentially applicable frameworks:
  - "social", "economic", "environmental" and "institutional" (UN SDI's components), corresponding to D, S, and R.
  - "environmental pollution", "ecological resources", "social pressure", "economic pressure", "institutional response" (Taiwan's SDEI, the S, D, and R have already been incorporated into the categories.)
  - "environmental systems", "reducing environmental pressure", "reducing human vulnerability", "social and institutional capacity" (ESI components excluding "international stewardship")

Determination of the framework (II)

- The following framework is selected:

	LESIT			
	environment	economy	society	institution
Driving force (D)				
State (S)				
Response (R)				

Candidate indicators (I)

- Environment
  - Climate change
  - Air quality
  - Noise
  - Water quality
  - Water quantity
  - Land
  - Wastes
  - Biodiversity
  - Ecological pressure
- Economy
  - Income
  - Production
  - Computerization
  - Commerce

- Society
  - Human population
  - Life stability
  - Education
  - Social support
  - Public safety
  - Health
  - Social dynamics
  - Social order
- Institution
  - Local sustainability
  - Traffic
  - Suffering index
  - Internationalization
  - Greening activities

Candidate indicators (II)

- Some examples in the "environment" component:

indicator	Sub-indicator (variable)	+ or -	DSR attribute
Climate change	Per capita GHG emission		
	Per GDP GHG emission		
	Use of renewable energy (solar and wind)		
Air quality	Percentage of days in a year with PSI > 100		
	Growth rate of motor vehicles		
Noise	Percentage of violations in environmental noise tests		
Water quality	Coverage of potable water services		
	Percentage of violations in potable water tests		
	Connection percentage of sewage systems		
	Removal rate of pollutant in wastewater		
	Percentage of river length with a RPI rated as moderately or severely polluted		
	Eutrophication of reservoirs and lakes		

Indicators to be included as possible

34.6 ton/capita/year   6.5 ton/capita/year
      Taipei   Kaohsiung
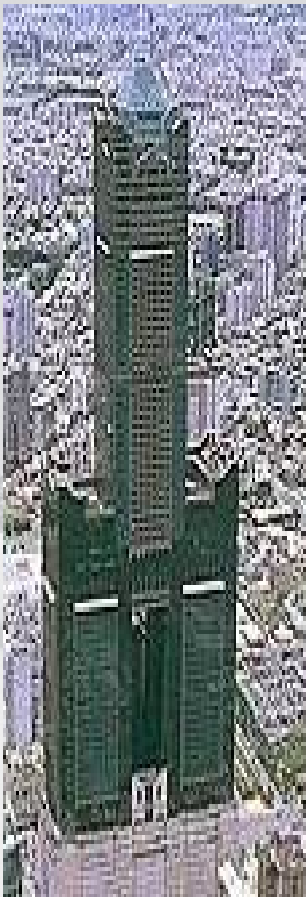
- Per capita GHG emission
- Per GDP GHG emission
- Use of renewable energy (solar and wind)

An example for quantification

Example: social increase rate (‰)

    The social increase rate of the 23 counties/cities in Taiwan Province between 2000 and 2004 were -15.35~ 26.81‰. Those for the major Asian cities from 1999 to 2003 were -11.43 ~ 16.09‰. Thus, the referential range was determined as -15 ~ 15‰

    x: social increase rate(‰), y: social increase rate index (0~1)

$$
\begin{cases}
x \geq 15 \ , \ y = 1 \\
-15 < x < 15 \ , \ y = \dfrac{x-(-15)}{15-(-15)} = \dfrac{x+15}{30} \\
x \leq -15 \ , \ y = 0
\end{cases}
$$
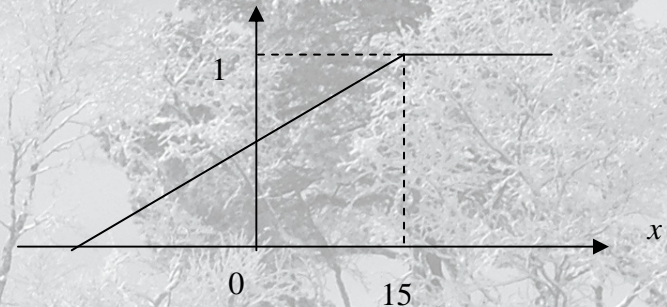
Works to be followed

Main tasks to be followed

- Screening and simplifying the indicators and framework through employing the ad-hoc approach and the Delphi Method

- Formulating the indicators and identifying the data sources

- Implementing a case study in a county

- Promoting the LESIT to all counties/cities in Taiwan

Thank you very much!