Analyzing Social Benefit from GEMS (MP-GEO)

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Cost/Benefit Analysis

- Why do we need to conduct B/C analysis for this project?

-Korean government mandated to conduct economic analysis for the public projects, of which costs exceed the certain amount.

- Present Value of Benefit-Cost Ratio

Benefit-Cost Ratio (B/C) = $$\sum_{t=0}^{n} \frac{B_t}{(1+r)^t} \Big/ \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

1) Measuring Social benefits and social costs-–externalities and public good

- Social discount rate; 5.5%
- OECD PPP rate with exchange rate considered: 753.98 won/ $1 in 2008
- Period for analysis
  - Project period: started in 2009 and launch at 2016
  - The life span of GEMS: 10 years after launching

Social Benefits from GEMS

- what is being valued: Main services provided by GEMS
  - Provide a reliable and accurate AQ monitoring and forecasting information
  - provide information on atmospheric composition that supports policies on air quality and climate changes, induces individuals to change their behavior to alleviate adverse health effects from air pollution.
  - not valuing air quality improvements but valuing the system which provide the data and information necessary to monitor and forecast air quality.
  - Information has economic value only to the extent that it can improve the quality of decision made.

- With/without GES scenario
  - In-situ and ground measurement station + satellite data from foreign countries

    given regulatory policy changes
  - Complementary to the existing measuring system—added value

    How much changes might be obtained in the SO2 levels?

Literature Review

- Economic and Social Value of Selected NOAA Data and Products for GOES: Funded by NOAA, 2007.

- Social benefits categories provided by the GOES system

1. Enhanced human health (both mortality and morbidity)
V 2. Reduced disaster losses—Tropical Cyclones
3. Improved weather forecasts-avoiding aviation delays
V 4. Better management of energy resources
V 5. Enhanced protection and utilization of water resources
6. Improved understanding of climate variability and changes
V 7. Support for sustainable uses of ag. forest and natural resources
8. Development of capability to make ecological assessments
9. Protecting and monitoring ocean resources

- Used costs of saving approach or cost avoidance approach

Literature Review

- Socio-Economic Benefits Analysis of GMES, by EU and ESA, 2006
- Social benefits categories provided by GMES

1) efficiency benefits

--improved cost effectiveness of implementing, enforcing or assessing polices that are currently in place

2) policy formulation benefits:

--relate to improved definition, and Implementation of new policies for which GES information would be used from the early formulation stages.

3) Global Action Benefits:

--relate to the use of GES information in formulating, improving and implementing global policy agreements (for climate changes, desertification, deforestation).

- Focused on benefits from weather forecasting: loss reduction in tropical clone, aviation industry, energy demand, irrigation of crops, recreational boating

Literature Review

- GMES Service Element PROMOTE: C2 Cost Benefit Analysis for Service Portfolio, 2006
- PROMOTE provide information on atmospheric composition that supports policies on Ozone, UV, air quality and climate changes.
- Added Value of PROMOTE

1) Ozone/UV : skin cancer, provide input to weather forecast model for middle range forecasting (5-10 days),

2) Climate change: increase accuracy of weather forecast.

3) Air quality monitoring: complements ground measurement provides the global picture and long term air pollution trends i

4) Air quality forecasting: improve accuracy of air quality forecasting

◆ No doubts that social benefits from the GEMS or GOES are huge

but most of benefits are intangible, externalities and public goods

-- possibility of market failure and non-marketed goods

Categories of Benefits from GEMS

Added Value of GEMS comp. to ground measurement stations

GEMS services		Added Value of GEMS
AQ Monitoring	Domestic	• Complements ground measurement by adding information • Provide daily map and long-term air pollution trends • Provide information to validates and improve air quality modeling • Provide input to weather forecast models (Ozone)
	Trans-boundary, Climate changes	• Provide global picture and long-term homogeneous AQ monitoring thruout the Asia • Provide tracks and map of long-range trans-boundary air pollution and ocean pollution –relied on foreign satellite data •Improved understanding of climate variability and changes
AQ Forecasting		• Improve accuracy of air quality forecasting • Provide AQ forecasting services to wide range of regions • provide input to weather forecast model for middle range forecasting (5-10 days),--time for averting behavior

Total Values: Use & Non-use value

Types of Benefits			Examples of Benefits	Valuation
Use Value	Direct Benefits	Tangible	• Cost saving of grounded measurement stations • Cost avoidance of high-tech industry or leisure activities	RCM* COS ABM
		Intangible	• Systematic approach for potential international conflicts and climate changes negotiations	CVM
	Indirect Benefits	Tangible	• morbidity and mortality reduction • reduction in agricultural crops damage	ABM COS
		Intangible	• Improved life quality of individuals • provide information for good policy formulation	CVM
Non Use Value	Intangible		・Synergy effect by simultaneous loading of weather, ocean and environmental satellites • PR/ national image improvement • Active approach for environmental conflict among nations	CVM

Non-Market Valuation Methods

Linkages with Preferences		Valuation Methods
Physical Linkage		Damage Function Approach **Replacement Cost Approach** **Cost of Savings Approach** **Cost of Avoidance Approach**
Behavioral Linkage	Revealed Preference Approach	Travel Cost Approach Hedonic Price Approach **Averting Behavior Approach**
	Stated Preference Approach	**Contingent Valuation Method** Contingent Ranking Method Contingent Behavior Method
	Benefit Transfer	Value Transfer, Meta analysis

Cost of Saving Approach

- **Followed Added Value Approach by GMES and PROMOTE case**
- **Conservative scenario to avoid double counting**

(1) Enhancement of investment in AQ ground measurement infrastructure

Efficiency gains Ozone Monitoring

- Assumption: By complementing with satellite data, the value of ground measurement may be improved by 10-30%
- 10% cost of saving in replacement costs

(1) Improved weather forecast resulting in cost avoidance to society

- Assumption
  - GMES Improved weather forecast(5-10 days) reduces overall damages by 5%
  - Using PROMOTE, improve accuracy of weather forecast by 2%
- Korean case
  - Annual (‘98-’07) property damages due to extreme weather events: $2,6 bil

Cost of Saving Approach

(3) Reducing Mortality Risks By increasing the accuracy of PM and O3 air pollution level

- Assumptions
  - High quality measurement using GMES will account for 5% of mortality reduction
  - Enhancement and complementarities of PROMOTE accounts for 5%
- Korean Data
  - Annually 11,127 premature death in Seoul metropolitan area due to PM and deterioration of AQ (2004)
  - About 20,000 premature death when extrapolated to the nation
  - Value of statistical life: on the average $0.71 mil (2008)

Costs of Saving Approach

(4) Reducing Health Costs due to Morbidity Reduction

- Respiratory patients'averting behavior in response to increase in AQ FC may reduce health costs
- Assumption
  - The accuracy of AQ FC can be improved by 25% by applying GMES
  - The improvement of AG FC may save health costs by 1%
- Korean data
  - Annual respiratory patients visiting hospitals; 7.14 million in 2007
  - Medical expense per asthma outpatient: $53.3

(5) Other intangible public goods—not evaluated

- In the process of conducting a Contingent Valuation survey

Research Issues on the Table

- In designing CVM questionnaire, what is being valued?
  - what is the main services or goods from GEMS?
  - what kinds of atmospheric composition may be included?—Ozone, UV?

- What may be the benefit categories from GEMS?

- How much change might be expected in AP levels by launching GEMS compared with ground measurement stations?

- What is the difference between services provided by GMES and those provided by PROMOTE?

- How much can I rely on the assumptions made by PROMOTE? Can we use those assumptions for EU to Korea?

- Are you conducting any type of non-market valuation research other than applying cost of saving approach or cost avoidance approach?
  - we are preparing a CVM study as well as averting behavior study?

Research Issues on the Table

- How responsive may be individuals after receiving information?
- How much overlap benefits between weather and environmental satellites'?
- Can you introduce economists involved in this area of research as contacting points?

Thank You