The Economic Value of the Coastline Protection in Korea

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Nov. 5. 2014

Korea Maritime Institute
Overview

- Coastal Status and Issues
- Economic Benefit of Coastline Protection
- Valuation of the CP: analysis result
- Concluding Remarks
I. Coastal Status and Issues
Coastal Status and Issues

**PRESSURE – STATE – RESPONSE**

Demand for Coastal Space use has Increased

- 26.9% of the total population lives in coastal areas.
- 78% of nation’s industrial complexes, and 66% of industrial plants are located there.
- Demand for coastal tourism compared to the total number of tourists: ('00) 27% → ('10) 41%

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2010</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nation’s total land area</td>
<td>99,540km²</td>
<td>99,897km²</td>
<td>357km² increase (reclamation)</td>
</tr>
<tr>
<td>Mud flat area</td>
<td>2,550km² ('03)</td>
<td>2,489km²</td>
<td>61km² decrease</td>
</tr>
<tr>
<td>Population</td>
<td>12,636,000 people</td>
<td>13,391,000 people</td>
<td>Increase of 754,000</td>
</tr>
<tr>
<td>Population Density</td>
<td>398/km²</td>
<td>417/km²</td>
<td>19/km² increase</td>
</tr>
<tr>
<td>Industrial complexes</td>
<td>162</td>
<td>240</td>
<td>Increase of 78</td>
</tr>
<tr>
<td>Cargo Volume</td>
<td>833M Tons</td>
<td>1,076M Tons</td>
<td>243M Ton increase</td>
</tr>
</tbody>
</table>
Coastal Status and Issues

**Total coastline: 14,936 km**
- 31.8% of coastline: Artificial
- 6.3% of coastline: Sand

### Issues

<table>
<thead>
<tr>
<th>Location</th>
<th>East Coast</th>
<th>South Coast</th>
<th>West Coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Issues</td>
<td>erosion</td>
<td>erosion, flooding</td>
<td>erosion, flooding</td>
</tr>
</tbody>
</table>

**As a result of video monitoring in the 27 subject area, beach width was reduced by 3.5% average**

- Research and analysis of coastal changes through long-term monitoring
- Monitoring sites: 172 sites (video monitoring sites: 27) ➔ 225 sites (being planned)
- Duration: on going since 2003
Causes of Erosion

1. **Natural causes**
   - wave, current, wind, etc.

2. **Artificial causes**
   - Installation of coastal and river structures, borrowing of marine sand, dredging, etc.
Coastal Erosion Management Policy

PRESSURE – STATE - RESPONSE

Coastal Improvement Plan

- Legal basis: Article 13 of Coastal Management Act
- Established and revised by Ministry of Oceans & Fisheries every 10yrs
- 2 Types of Coastal improvement projects
  - To protect the seashore from tidal waves, wave surges, sea water, ground erosion, etc. and maintenance of damaged sections of seashore
  - To facilitate the pleasant use of coasts, such as the creation of recreational areas

<table>
<thead>
<tr>
<th>Items (in 2014)</th>
<th>Total</th>
<th>Coastline protection</th>
<th>Waterfront project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects (No.)</td>
<td>370</td>
<td>296</td>
<td>74</td>
</tr>
<tr>
<td>Budget (mil.$)</td>
<td>1,834</td>
<td>1,464</td>
<td>370</td>
</tr>
</tbody>
</table>
Types of Coastal Improvement Project

Protection of the coastline
- Revetment, under water revetment

Restoration of beach & Dunes

ECO-Waterfront space
- Coastal trails, eco-space
II. Economic Benefit of Coastline Protection
Economic Benefit of CP

Total Economic value of environment

Total Economic Value
- Use values
  - Actual value
    - Direct use
      - Consumptive
        - Crops, livestock, fisheries, wild foods, aquaculture
      - Non consumptive
        - Recreation, spiritual/cultural well-being, research education
    - Indirect use
      - Pest control, pollination, water regulation and purification, soil fertility
  - Option value
- Non-use values
  - Philanthropic value
  - Altruism to biodiversity
  - Existence value
    - Bequest value
    - Altruist value
    - Satisfaction of knowing that other people have access to nature’s benefits
    - Satiability of knowing that a species or ecosystem exists

Source: The Economics of Ecosystems and Biodiversity: The Ecological and Economic Foundations (2010), Chapter 5 p.14
# Economic Benefit of CP

## Cost-Benefit Category of CP

<table>
<thead>
<tr>
<th>contents</th>
<th>Coastal improvement project</th>
<th>Waterfront project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(protecting from erosion, flooding, etc.)</td>
<td>construction cost, operating cost, land acquisition cost, reserve fund, etc</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>construction cost, operating cost, land acquisition cost, reserve fund, etc</td>
<td>construction cost, operating cost, land acquisition cost, reserve fund, etc</td>
</tr>
<tr>
<td>Private cost</td>
<td>- desecrating coastal natural landscape and environmental quality by artificial structure</td>
<td>- environmental cost for excess use of waterfront park</td>
</tr>
<tr>
<td>Social cost</td>
<td>- Another erosion damages unexpected</td>
<td>-</td>
</tr>
<tr>
<td><strong>Benefit</strong></td>
<td>Private benefit</td>
<td>- (entry fees)</td>
</tr>
</tbody>
</table>
| Social benefit | - **Disaster prevention**  
(Agricultural, industrial, residential damage mitigation in hinterland) | - Coastal tourism and public access improvement |
|           | - **Public access improvement**  |
|           | - **Coastal landscape improvement**  |
|           | - **Coastal environment improvement**  
(water quality, ecological environment, natural restore) | - improvement of residential environment |
|           | - Educational value | - Coastal landscape improvement |
|           | - Coastal environment improvement (water quality, ecological environment, natural restore) | - Coastal environment improvement |
| Indirect Effect | Employment Inducing effect  
Regional economic effect  
(produce inducing effect, value added inducing effect etc) | - |
## Economic Benefit of CP

<table>
<thead>
<tr>
<th>Type of project</th>
<th>Researcher</th>
<th>Site or Area</th>
<th>Benefit factors</th>
<th>Economic value [99% confidence interval]</th>
<th>Unit</th>
<th>Total value</th>
<th>Unit</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Erosion mitigation on Sandy beaches</strong></td>
<td>MLTM (2009)</td>
<td>Busan Haundae</td>
<td>Recreation value</td>
<td>110,900</td>
<td>KRW/visit/person (2009)</td>
<td>-</td>
<td>Travel Cost Method</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Gangneung Gyungpodae</td>
<td>Recreation value</td>
<td>119,690</td>
<td>-</td>
<td>-</td>
<td>Travel Cost Method</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Busan Haundae</td>
<td>Damage cost for beach erosion width 10% decreasing width 30% decreasing</td>
<td>- 32,493 - 64,986</td>
<td>- 35,069 - 70,138</td>
<td>Conjoint Analysis Method (Choice experiment)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Gangneung Gyungpodae</td>
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<td>-</td>
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<tr>
<td></td>
<td>- Busan Haundae</td>
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<td></td>
<td>- Geoje Hakdong</td>
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<td>- Chungnam Daecheon</td>
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<td>- Jeonnam Yulpo</td>
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<td></td>
<td>- Incheon Youngjongdo Ulwangli</td>
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<td></td>
<td>- Jeonbuk Buan Gyukpo</td>
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<tr>
<td><strong>Coastal Forest restoration (Preventing disaster)</strong></td>
<td>Chang and Yuk (2009)</td>
<td>Anmyeondo Kkojiti beach</td>
<td>- Protecting from disaster (Agricultural, residential damage mitigation in hinterland) - Coastal landscape - Recreational value</td>
<td>1,793.5 [1,487.5~2,203.1]</td>
<td>KRW/year/household (Seoul and Metropolitan Area household)</td>
<td>27.7 [23.0~34.1 ]</td>
<td>billion KRW/yr (2009)</td>
<td>Contingent Valuation Method</td>
</tr>
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</table>
III. Valuation on the CP
How much is the potential value of the coastline protection?

Analyzing the Potential Value of the project using non-market valuation method

To give decision maker quantitative information on benefits from project
To enhance sustainable use of natural coastline
Valuation on the Coastline Protection

Model

- **Choice Experiment**
  - has been widely used in the environmental field for measuring people’s preferences
  - Survey method
  - CE allows respondents to systematically evaluate trade-offs between multiple attributes

- **Using Random Utility model**
  - Multinomial logit model developed by McFadden(1973))

- Calculating **MWTP (Marginal Willingness to Pay)**
Survey design

- Respondent: the whole country
  670 Householders (20~65 year-old,)
- Random sampling
- Person to person Interview (AUG. 2014.)

<attributes and Choice set>
- Select 4 attributes, 2~5 levels each
- Orthogonal Design for choice set
- Respondents have to choose 4 times
  → total 2,680 data
# Valuation on the Coastline Protection

## Attributes and levels of coastline Protection

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Protection levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>present</td>
</tr>
<tr>
<td>Damage reduction</td>
<td>nothing</td>
</tr>
<tr>
<td>Beach restoration</td>
<td>Nothing</td>
</tr>
<tr>
<td>ECO-Waterfront space</td>
<td>Nothing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WTP per household per year</th>
<th>0</th>
<th>3,000 KRW</th>
<th>5,000 KRW</th>
<th>8,000 KRW</th>
<th>12,000 KRW</th>
</tr>
</thead>
<tbody>
<tr>
<td>By Income Tax</td>
<td>2.8 USD</td>
<td>4.6 USD</td>
<td>9.4 USD</td>
<td>11 USD</td>
<td></td>
</tr>
</tbody>
</table>
## Valuation on the Coastline Protection

### Sample of choice card

Q. Please, Choose most Preferred alternative.

No : 1 (ID=31)  | alternative A | alternative B |
---|---|---|
**Damage reduction**  | Coastal structure Damage reduction | Coastal structure + Hinterland village and agricultural land |
**Beach restoration**  | 1.5 times of width | Nothing |
**ECO-Waterfront space**  | Nothing | Coastal trails |
**Cost per household per year By Income Tax (KRW)**  | 8,000 | 10,000 |

☐ A  
☐ B  
☐ neither
## Valuation on the Coastline Protection

### Estimation results of the WTP per attribute

<table>
<thead>
<tr>
<th>Attributes</th>
<th>WTP of level 2 (unit: KRW per household per year)</th>
<th>( t )-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Damage reduction</strong></td>
<td>Coastal structure + Hinterland village and agricultural land 8,603.8 7.9 USD</td>
<td>9.676512 **</td>
</tr>
<tr>
<td><strong>Beach restoration</strong></td>
<td>2 times of width 11,079.7 10.2 USD</td>
<td>10.75442 **</td>
</tr>
<tr>
<td><strong>ECO-Waterfront space</strong></td>
<td>Coastal trails + Eco-space 16,174.3 14.9 USD</td>
<td>10.23504 **</td>
</tr>
</tbody>
</table>

\( *, ** \) indicates significance at the 5% and 1% levels, respectively

→ **Recreational value is higher**  
    *(Economic Valuation is anthropocentric approach)*
The results give decision makers quantitative information on social preferences for policy and its benefits.

- To insure more accurate assessment of project it should be supported by scientific and engineering analysis (on the causes of erosion, expectations of damages, mitigation effect)

- To enhance the effectiveness of projects, social and private costs should be reduced
  → by selecting and designing proper facilities (or types or method of construction), and investigating the social preferences
Concluding Remarks

Future works

1. Economic valuation Guide lines for coastline protection project → more accurate benefit –cost analysis

2. Actual Regulations and guidelines for the Economic Validity analysis Process of Coastal Improvement project
   Project Assessment for the establishing plan(Multi-Criteria Analysis) → preliminary feasibility Assessment for each project(BC Analysis)
   → post feasibility Assessment for each project(BC Analysis)
THANK YOU FOR YOUR ATTENTION!

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