ESTIMATION OF THE TOTAL ECONOMIC VALUE OF IMPROVING WATER QUALITY IN URBAN AREA (CASE STUDY ON METRO MANILA WATERBODIES)

Shokhrukh Jalilov
Water & Urban Initiative, United Nations University – Institute for the Advanced Study of Sustainability

The 1st Symposium on Sustainable Urban Water Environment, March 14, 2016
BACKGROUND: WATER RESOURCES

- Crucial to human health and the natural environment
- Vital for the world economy

However, have been degraded and depleted, in terms of:

- Water quantity
- Water quality

From economic perspective, water resources are over-extracted and are not efficiently allocated due to:

- Market and government failures
- Private costs and benefits diverge from social costs and benefits
INTRODUCTION: LOW QUALITY OF METRO MANILA WATERBODIES

According to DENR (*Department of Environment and Natural Resources*):

- only 20% to 30% of Metro Manila homes are connected to central sewage system (*Manila Water and Maynilad Water Services*).
- The other 70% depend on septic tanks, which may leak human waster into underground aquifers.
INTRODUCTION: LOW QUALITY OF METRO MANILA WATERBODIES

- Some may not even have septic tanks – meaning untreated residential waste flows directly into the waterbodies.
- Informal settlers who live right next to waterways cause another problem. Lack of awareness and discipline means they throw trash and defecate directly into the water.
- Low quality of urban waterways means low quality of Manila Bay.
GOVERNMENT RESPONSE: METRO MANILA
ADOPT-AN-ESTERO OR WATERBODY PROGRAM

- Increasing of local awareness – Information campaign.
- Cleaning of waterbodies (out of the more than 240 waterbodies in the mega city, only 27 or 11% are covered by the program).
- The DENR has enforced a deadline for utility companies to achieve 100% coverage of Metro Manila by 2035.
- By law, no structures are allowed in the 3-meter easement beside waterbodies - after the 3rd warning, a team goes to the houses and begins demolition.
- New water treatment facilities.
WATER QUALITY MANAGEMENT ISSUES
CURRENT STUDY QUESTION

- Generally, water quality improvement programs can be very significant even for the mega city like Manila.
- The costs could vary considerably depending on existing or planned water quality standards, scale and characteristics of the adopted measure, etc.
- Cost of potential treatment measures helps water managers to evaluate costs of water quality improvement.
- However, what are the benefits of maintaining or improving the quality of the urban waterbodies in Manila?
- Because water quality regulation is expensive this study is intended to estimate the benefits of water quality improvement.
STUDY OBJECTIVES:
ESTIMATION OF BENEFITS OF WATER QUALITY IMPROVEMENT

1. Highlight the need for economic analysis
2. Conduct economic evaluation of improving water quality
3. Demonstrate how method can be used for sustainable water resources management
# ECONOMIC VALUE OF WATER

<table>
<thead>
<tr>
<th>USE VALUE</th>
<th>NON-USE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct use values</strong> (irrigation, domestic and industrial supply, energy resources, transport and navigation, recreation, wildlife harvesting, etc.)</td>
<td><strong>Existence value</strong> (value the conservation of a resource which will never be directly used by you or by future generations)</td>
</tr>
<tr>
<td><strong>Indirect use values</strong> (flood control, nutrient retention, storm protection, etc.)</td>
<td><strong>Bequest value</strong> (value the fact that future generations will have opportunity to enjoy a resource)</td>
</tr>
<tr>
<td></td>
<td><strong>Altruistic value</strong> (resource will be available to others in the current generation)</td>
</tr>
<tr>
<td></td>
<td><strong>Option values</strong> (potential to provide economic benefits to humans in the future)</td>
</tr>
<tr>
<td></td>
<td><strong>Biodiversity</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Cultural heritage</strong></td>
</tr>
</tbody>
</table>
VALUATION METHODS

- **Stated preferences**
  - Or *Direct valuation* methods have been developed to solve the problem of valuing those environmental recourse that are not traded in any market, including surrogate ones.
  - Contingent valuation method
  - Choice experiment method

- **Revealed preferences**
  - Or *Indirect valuation* methods look for related or surrogate markets in which the environmental good is implicitly trade
  - Hedonic pricing
  - Travel cost method

The 1st Symposium on Sustainable Urban Water Environment, March 14, 2016
STUDY METHODOLOGY: CONTINGENT VALUATION METHOD (CVM)

- CVM to estimate Willingness To Pay (WTP) to prevent water quality degradation and WTP to support improvements in water quality in a city’s waterbodies
- Scenario of action: feasible and reliable
- Enforcement mechanisms through: increased income taxes, property taxes, and increased housing costs
STRUCTURE OF CVM
THE TARGET POPULATION – METRO MANILA HOUSEHOLDS

Survey consists of three parts:

1. Introductory section - Information about the city’s waterbodies, water quality, pollution sources, and the resulting ecological impacts from water quality degradation. Reveal people’s behavior – ask to identify which factors, if any, motivate them to prevent degradation of water ecosystems.

2. Main section – identify Willingness To Pay (WTP)

3. Demographic questions
## Dimensions of Water Quality

<table>
<thead>
<tr>
<th>Level</th>
<th>Water clarity</th>
<th>Color</th>
<th>Algae</th>
<th>Nutrient levels</th>
<th>Oxygen</th>
<th>Odor</th>
<th>Aquatic life</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Excellent</td>
<td>None</td>
<td>Very little</td>
<td>Very low</td>
<td>Very high</td>
<td>No</td>
<td>Very healthy, abundant</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>Little</td>
<td>Little</td>
<td>Low</td>
<td>High</td>
<td>Little</td>
<td>Healthy, abundant</td>
</tr>
<tr>
<td>3</td>
<td>Fair</td>
<td>Some</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Little</td>
<td>Somewhat healthy, abundant</td>
</tr>
<tr>
<td>4</td>
<td>Poor</td>
<td>Noticeable</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Noticeable</td>
<td>Unhealthy, scarce</td>
</tr>
<tr>
<td>5</td>
<td>Poor</td>
<td>Considerable</td>
<td>Very high</td>
<td>Very high</td>
<td>Low to no</td>
<td>Strong offensive</td>
<td>Unhealthy, scarce or none present</td>
</tr>
</tbody>
</table>

Source: Van Houtven et al., 2014
WATER QUALITY SCENARIOS

I. Current condition

BAD

II. Irrigation & Livestock

POOR

III. Fishery & boating

FAIR

IV. Bathing & swimming

GOOD
### SURVEY DESIGN: SCENARIOS
### HOW MUCH ARE YOU WILLING TO PAY FOR?

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Attribute associated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Class AA</td>
<td>Waters intended as public water supply requiring only approved disinfection to meet the PNSDW</td>
<td></td>
</tr>
<tr>
<td>2 Class A</td>
<td>Waters suitable as water supply requiring conventional treatment to meet the PNSDW</td>
<td></td>
</tr>
<tr>
<td>3 Class B</td>
<td>Waters intended for primary contact recreation (e.g. bathing, swimming, skin diving, etc.)</td>
<td></td>
</tr>
<tr>
<td>4 Class C</td>
<td>Waters for fishery, recreation/boating, and supply for manufacturing processes after treatment</td>
<td></td>
</tr>
<tr>
<td>5 Class D</td>
<td>Waters intended for agriculture, irrigation, livestock watering, etc.</td>
<td></td>
</tr>
</tbody>
</table>

*Source: EMB National Water Quality Status Report, 2006*
Sampling size – 1186 households

Questions – open-ended and close-ended

Methodology – econometric analysis
STRATIFIED RANDOM SAMPLING

<table>
<thead>
<tr>
<th>Metro Manila</th>
<th>Absolute Numbers</th>
<th>%</th>
<th>Number of respondents</th>
<th>which is 1% of total population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro Manila</td>
<td>11,855,975</td>
<td>100.00</td>
<td>proportion</td>
<td>1186 respondents</td>
</tr>
<tr>
<td>City of Malabon</td>
<td>353,337</td>
<td>2.98</td>
<td>0.03</td>
<td>35 respondents</td>
</tr>
<tr>
<td>City of Navotas</td>
<td>249,131</td>
<td>2.10</td>
<td>0.02</td>
<td>25 respondents</td>
</tr>
<tr>
<td>City of Valenzuela</td>
<td>575,356</td>
<td>4.85</td>
<td>0.05</td>
<td>58 respondents</td>
</tr>
<tr>
<td>Caloocan City</td>
<td>1,489,040</td>
<td>12.56</td>
<td>0.13</td>
<td>149 respondents</td>
</tr>
<tr>
<td>City of Marikina</td>
<td>424,150</td>
<td>3.58</td>
<td>0.04</td>
<td>42 respondents</td>
</tr>
<tr>
<td>City of Pasig</td>
<td>669,773</td>
<td>5.65</td>
<td>0.06</td>
<td>67 respondents</td>
</tr>
<tr>
<td>Pateros</td>
<td>64,147</td>
<td>0.54</td>
<td>0.01</td>
<td>6 respondents</td>
</tr>
<tr>
<td>Taguig City</td>
<td>644,473</td>
<td>5.44</td>
<td>0.05</td>
<td>64 respondents</td>
</tr>
<tr>
<td>Quezon City</td>
<td>2,761,720</td>
<td>23.29</td>
<td>0.23</td>
<td>276 respondents</td>
</tr>
<tr>
<td>City of Makati</td>
<td>529,039</td>
<td>4.46</td>
<td>0.04</td>
<td>53 respondents</td>
</tr>
<tr>
<td>City of Mandaluyong</td>
<td>328,699</td>
<td>2.77</td>
<td>0.03</td>
<td>33 respondents</td>
</tr>
<tr>
<td>City of San Juan</td>
<td>121,430</td>
<td>1.02</td>
<td>0.01</td>
<td>12 respondents</td>
</tr>
<tr>
<td>City of Manila</td>
<td>1,652,171</td>
<td>13.94</td>
<td>0.14</td>
<td>165 respondents</td>
</tr>
<tr>
<td>City of Las Piñas</td>
<td>552,573</td>
<td>4.66</td>
<td>0.05</td>
<td>55 respondents</td>
</tr>
<tr>
<td>City of Muntinlupa</td>
<td>459,941</td>
<td>3.88</td>
<td>0.04</td>
<td>46 respondents</td>
</tr>
<tr>
<td>City of Paraque</td>
<td>588,126</td>
<td>4.96</td>
<td>0.05</td>
<td>59 respondents</td>
</tr>
<tr>
<td>Pasay City</td>
<td>392,869</td>
<td>3.31</td>
<td>0.03</td>
<td>39 respondents</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,855,975</strong></td>
<td><strong>100.00</strong></td>
<td><strong>1.00</strong></td>
<td><strong>1186 respondents</strong></td>
</tr>
</tbody>
</table>
STUDY PARTNERS: POSSIBLE LOCAL STAKEHOLDERS AND BENEFICIARIES

- Environmental Management Bureau (EMB) of DENR (Department of Environmental and Natural Resources)
- PRRC (Pasig River Rehabilitation Commission)
- Department of Health (DOH)
- Local municipalities, universities
- Others...
CONCLUSION: POLICY IMPLICATIONS

- To assist in the design of efficient, equitable and sustainable policies for water resources management in face of water pollution
- The results can be used to compare benefits and costs of the specific management strategies for improving water quality of Metro Manila waterways. As expected, policy-making authorities will be able to compare costs of the certain water quality improvement measure with identified benefits
- Results of the study could be used by other Philippines cities’ authorities through benefit transfer method
MAJOR ISSUES IN JAKARTA

- Environment
  - Water pollution: concentration of DO, Ni, Cu, Zn, Hg above standard
  - Land subsidence
  - Lack of open green spaces

- Water Resources
  - Low quality and quantity of clean and raw water especially in north Jakarta
  - Limited coverage of piped wastewater network
  - Excessive extraction of groundwater that causes land subsidence and sea water intrusion

Source: Jakarta Capital City Administration
THANK YOU!

QUESTIONS & COMMENTS?

Water & Urban Initiative
UNU-IAS (United Nations University
Institute for the Advanced Study of Sustainability)
5-53-70 Jingumae, Shibuya-ku,
Tokyo 150-8925
REFERENCES


- Grey Solutions for Urban Water Management: Jakarta case. Presentation by Feirulla Irzal, MBA. Senior Planner. Jakarta Capital City Administration.

- Photos from Google Images unless otherwise noted