An economic framework for wastewater irrigation: Cost-benefit analysis and financial considerations

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Main Source

NEW FAO WATER REPORT

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• The need of economic appraisal of reuse projects

• Steps in an economic appraisal of a reuse project
  • Economic justification
  • Financial feasibility

• Case Study. The Llobregat Delta (Spain). Reality check

• Final remarks
Why an economic appraisal

Reuse technology is mature and feasibility of reuse projects depends almost exclusively on:

- **economic aspects**
- **social acceptability**
- **rules and regulations**
Steps in an economic appraisal

- **Economic justification**
  Are Total Benefits higher than Total Costs?
  Cost-benefit analysis

- Is reuse the most cost-effective approach?
  Are there better alternatives?
  Cost-effectiveness analysis

- **Financial feasibility**
  Who pays? And how?
Economic justification
Boundaries and parties

- Cities
- Agriculture
- Environment
## Potential Benefits

**Farmers**

- Reliable source of water
- Savings in fertilizers
- Avoided costs of pumping
Potential Benefits

Cities

• Fresh water released by agriculture
• Avoided costs of freshwater abstraction and transmission from remote sources
• Savings in wastewater treatment
Cost-benefit analysis

Potential Benefits

Environment

• Lower contamination downstream

• Reduced freshwater abstraction

• Prevention of Mineral Fertilizer being extracted from mines: carbon foot print
Risks

- Contaminants in wastewater can harm human health and the environment

Minimizing risks = Cost

- Treatment options
- Non treatment options
Other costs

• New infrastructure
  Water pumping and conveyance

• Environmental costs
  Environmental impacts (e.g. Salinization)

• Health costs
  Illness due to infectious and chemical agents
If Total Benefits > Total Costs

Is the chosen reuse approach the most cost-effective approach?

Alternatives:

- Water Conservation
- Desalination
- Water transfer
- Others
Financial feasibility
Stakeholders:

• Farmers
• City authorities
• Regional or national government

Who benefits and who loses?
Financial instruments

- Subsidies
- Others
  - Soft loans
  - Payment for environmental services
  - Water charges
  - Pollution taxes
  - ...

FAO WATER

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

www.fao.org/nr/water
A Reality Check: The Llobregat Delta (Spain)
WATER EXCHANGE

7.3 Mm³/yr

Reallocated Freshwater

Reclaimed wastewater

A reality check: Llobregat Delta (Spain)
## A reality check: Llobregat Delta (Spain)

### Costs:

<table>
<thead>
<tr>
<th>Cost</th>
<th>Mill €/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater treatment</td>
<td>0.59</td>
</tr>
<tr>
<td>Wastewater conveyance</td>
<td>0.21</td>
</tr>
<tr>
<td>Freshwater conveyance</td>
<td>0.81</td>
</tr>
<tr>
<td>Total costs</td>
<td>1.61</td>
</tr>
</tbody>
</table>

### Benefits:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Mill €/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs savings in water abstraction</td>
<td>0.06</td>
</tr>
<tr>
<td>Cost savings in fertilizers</td>
<td>0.01</td>
</tr>
<tr>
<td>Increase in yields</td>
<td>0.39</td>
</tr>
<tr>
<td>Value of released freshwater</td>
<td>8.13</td>
</tr>
</tbody>
</table>

Unitary value of freshwater: 1.11 €/m³
If farmers pay the costs

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Total costs</td>
<td>1.61 Mill €/year</td>
</tr>
<tr>
<td>Farmers benefit</td>
<td>0.46 Mill €/year</td>
</tr>
<tr>
<td>Net benefit</td>
<td>-1.15 Mill €/year</td>
</tr>
</tbody>
</table>

The reuse project would not be justified
If the value of the fresh water released is accounted

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</tr>
<tr>
<td>Net benefit</td>
<td>6.98 Mill €/year</td>
</tr>
</tbody>
</table>

The reuse project would be fully justified!
Farmers are not committed to contribute to the cost of wastewater reuse

The city can pay

Win-win situation

<table>
<thead>
<tr>
<th>Net benefit of the city</th>
<th>Farmers Benefit</th>
</tr>
</thead>
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<tr>
<td>6.52 Mill €/yr</td>
<td>0.46 Mill €/yr</td>
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</table>
Economic appraisal of projects (including reuse projects) is an essential tool for water planning and allocation strategies within IWRM.

The FAO report provides a sound methodology for the economic justification of reuse projects.
Application of this methodology to real reuse cases has shown that:

A positive net benefit can be gained from water exchange between agriculture and cities resulting in a win-win situation, while also delivering interesting environmental benefits.