Multiple Uses of Water in Large Irrigation Systems

Conceptual approach and Cost Benefit Analysis for Operation and Management

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MASSCOTE Approach: Auditing Irrigation Management

- Assessing performance of irrigation systems
- Introducing the concept of Service Oriented Management [SOM]
- Planning for modernization

**MUS is the norm**  **SUS are marginal**

**Goals:**

1. Operation and Governance of MUS systems
2. MUS/Policy levels (IWRM)
PLAN FOR MODERNIZATION
MONITORING & EVALUATION

(10) INTEGRATING SOM OPTIONS

(9) OPERATION IMPROVEMENTS/UNITS

(8) DEMAND for OPERATION

(7) MANAGEMENT UNITS

(6) USERS & SERVICE TO USERS

(5) COST of OPERATION

(4) WATER ACCOUNTING

(3) PERTURBATIONS

(2) CAPACITY & SENSITIVITY

(1) RAP

VISION for the agriculture and water systems
**Conceptualization of MUS in large irrigation systems**

Irrigated agriculture supply water to the natural ecosystems: *irrigation practice provides/supports ecosystems services*

<table>
<thead>
<tr>
<th>Productive-plus = ecosystem services provider</th>
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<tbody>
<tr>
<td>Provisioning of services</td>
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<tr>
<td>Domestic water</td>
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<tr>
<td>Food and fiber (irrigation)</td>
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<td>Water for cattle</td>
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<td>Transportation</td>
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<td>Hydropower</td>
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<td>Environmental flows</td>
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<td>Fuel (natural vegetation)</td>
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<td>Biochemicals and natural medicines</td>
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<td>Raw materials for construction</td>
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<td>Regulating Services</td>
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<td>Sanitation and wastewater treatment</td>
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<td>Flood protection</td>
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<td>Cooling effect on habitats</td>
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<td>Erosion control</td>
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**MEA Grid**
MUS in large irrigation systems

Service Providers

Direct path

Direct Service

Service Receivers

Provisional services

Indirect path

Service domain considered

Service Providers

Service

ECO-SYSTEM

Ecosystem Services

Service Beneficiaries

All types of services
• Command area considered from a bio-physical perspective as an agro-ecosystem providing critical ecosystem services to people

• A dynamic organic relationship between provider and users of services.

• In short a business service model intervening on a large ecosystem serving multiple uses
Defining services in practice?

Domestic

from WHO and UNICEF (Howard and Bartram, 2003) assessment in which they estimated that “one-sixth of humanity (1.1 billion people) lacked access to any form of improved water supply within 1 kilometre of their home”.

Type of improved and unimproved water supply according to the JMP.

<table>
<thead>
<tr>
<th>Improved Water supply</th>
<th>Unimproved water supply</th>
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</thead>
<tbody>
<tr>
<td>Piped into dwelling, plot or yard</td>
<td>Unprotected dug well</td>
</tr>
<tr>
<td>Public tap/standpipe</td>
<td>Unprotected spring</td>
</tr>
<tr>
<td>Tube well/borehole</td>
<td>Cart with small tank/drum</td>
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<tr>
<td>Protected dug well</td>
<td>Tanker truck</td>
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<tr>
<td>Protected spring</td>
<td>Surface water (river, dam, lake, pond, stream, canal, irrigation canal)</td>
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<tr>
<td>Rainwater collection</td>
<td>Bottled water</td>
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Water Deliveries
Support to raw water surface
Groundwater recharge
Control of water
Service? Raw water? physical Access? Distance to water?
Access

DISTANCE

Accessible canal/drainage/river

Groundwater access

Permanent surface water body
Example of zoning around the canal infrastructure for Shahapur Canal – Right blue Main and secondary canals – Left red with tertiary canals considered – Drainage network.
WBC shares per service: Water, Benefit & Cost

- Share of water used
- Share of benefits generated
- Share of cost of MOM
Share of benefits

• Definition of benefits of water service?
• Usually benefits = Monetary (gross production) for agriculture! or any productive activity as electricity, fishery, etc...
• Domestic ?? Households served for domestic,
• Environment ???
• Jobs for small business.
Critical Issues?

- References: building up a database!
- Methodology: MASSMUS rapid appraisal for mapping benefits
- Testing the Valuing methods for in depth MUS studies?
Share of estimated benefits

Kim Dong BHH Vietnam
Luong tai BHH Vietnam
Shahapur Karnataka India
KOISP Sri Lanka
Zanghe China

- **Power**
- **Drainage, Flood control, transport, environment**
- **Homestead garden & natural vegetation**
- **Fish**
- **Domestic & Industry (incl tourism)**
- **Animals**
- **Crops**
Value ($\text{ per m}^2\text{ per year} = 22.5 A^{0.36} [A= \text{ size in m}^2]

$y = 22.513x^{-0.6416}$

$R^2 = 0.6454$

After Renwick et al, 2007
Share of COST of MOM

Specific costs to produce each service.

- Services: Water Deliveries - Support to raw water surface – Groundwater recharge – Control of water
- Investment – Operation – Maintenance
Comparative advantage of MUS

• **Water multi-use:** “More DGs per drop”. BUT re-use of water drops is no exclusivity of MUS therefore the specificity of MUS needs to be well documented.

• **Cost-efficiency:** “MUS better than Σ SUS” numerous services to a greater number of users with the same infrastructure more cost-effective than achieving the same with single use systems.

• **Provision of extra services:** ecosystems services provided by MUS systems for which little or no alternatives exist

• **Externalities:** “MUS = positive externalities” YES BUT we should not forget the negative ones !!
Practical changes and research needed

• Local and policy levels: importance of MUS in serving people especially the more vulnerable, ultimately addressing more MDGs. Local studies reinforced by a set of worldwide case studies on the importance of MUS on irrigation systems and on the ways to operate a MUS system.

• Development of robust and simple methods to produce references

• a PILOT large MUS Irrigation system to investigate all issues related to MUS by a consortium of interested partners.
Summary

• Irrigation: Provide or support Ecosystems services
• WBC analysis (=CBA)
• RAP: Rapid MUS Water Benefit Cost Assessment
• MASSMUS 2nd phase appropriate Valuing methods → MUS governance & Operations

• More MDGs per Drop - MUS better than Σ SUS
• Extra services & Externalities

• Local & policy awareness
• References
• MUS Pilot