Training for Asian Young Professionals on Performance Assessment of Irrigation Systems (9th to 13th April 2018 in Beijing, China)
Performance assessment of Multiple Use Systems - The MASSMUS approach

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Irrigation systems have been constructed for the purpose of serving farmers with water for irrigation

YES But......water is de facto used for many other uses !!!!
Morocco Tadla – Domestic water

Nepal & Morocco: same scenes

Productive uses

Power generation unit along a Branch Canal Badra KNNL India

Power generation at main dam Badra KNNL India

Food production

Agriculture in CA

Fisheries in small reservoirs (tanks)
India Karnataka: domestic uses

Nepal Tap along a secondary canal SMIP

Cattle during fallow period
Sri Lanka Kirindi Oya

Urban uses of irrigation water

Urban wetlands in Taiyuan city

Urban parks in Taiyuan city
IWRM = Principles of water allocation among sectors at basin level.

MUS = Local practice by users/managers sharing the same infrastructure to produce more services

Conceptual approach: MUS & IWRM

Recognize the interrelationship between multiple uses and functions of water resources and integrated water resources management.

Multiple uses practices are an inherent element of the Integrated Water Resources Management (IWRM) approach, which aims to ensure that management approaches are effective in meeting the needs of all users. During dry periods, sound governance of these systems should be ensured to encompass the principles of IWRM and to recognize the needs of all stakeholders.

CA= An ecosystem supported by irrigation water

A command area is an aquatic ecosystem providing multiple services to various users.
Multiple Uses of Water

Successive Uses of water e.g. Transport + Hydro + irrigation + groundwater recharge + domestic water + reuse of waste water in agriculture

Several functions/roles associated to some uses of water and/or resulting of the circulation of water and/or the set of practices associated with water management

Multiple Functions/roles of Water Systems

Flow circulation within the system and practices

Function/Role 1

Function/Role 2

Function/Role 3

Multiple what?

Uses Intended vs unintended

Functions Externalities (positive-negative)

Roles Parallel or serial process

Purposes Uses & consumptive uses

Users and beneficiaries

Millenium Ecosystem Assessment (MEA)

Grid to group ecosystem services

Provisioning of services: Supporting Services

Domestic water

Food and fibers (irrigation)

Water for cattle

Transportation

Hydropower

Environmental flows

Fuel (natural vegetation)

Biochemicals and natural medicines

Raw materials for construction

Regulating Services: Cultural services

Water and wastewater treatment

Philosophies in nature

Coping with habitats

Invasion control

Cultural services: Cultural services linked to the infrastructure and management

Restoration and TOURISM

Uninhibited landscapes, values and landscapes (ex. fortress system)

MUS? in large irrigation systems

Direct path

Indirect path

All types of services

Service domain considered

Service domain considered

Ecosystem domain

SERVICES

Direct path

Indirect path

All types of services

Service domain considered

Service domain considered

Ecosystem domain

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

<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>
</tr>
<tr>
<td>Protected dug well</td>
<td>Tanker truck</td>
</tr>
<tr>
<td>Protected spring</td>
<td>Surface water (river, dam, lake, pond, stream)</td>
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<tr>
<td>Rainwater collection</td>
<td>Bottled water</td>
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Services / Operation

Water Deliveries
Support to raw water surface
Groundwater recharge
Control of water

Service? Raw water? physical Access?
Distance to water?
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 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?

First question: Degree of MUS?
One answer is number of MUS reported
Example: Rice fields = 7

Second question: integration of MUS in management?

<table>
<thead>
<tr>
<th>Indicator value</th>
<th>Management attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Ignoring or denying MUS and/or its magnitude</td>
</tr>
<tr>
<td>1</td>
<td>Blind eye on MUS practice by users</td>
</tr>
<tr>
<td>2</td>
<td>Positive marginal practices to support MUS</td>
</tr>
<tr>
<td>3</td>
<td>Integration of other services concerns into the operation</td>
</tr>
<tr>
<td>4</td>
<td>Integration of Multiple Uses Services into the management and governance.</td>
</tr>
</tbody>
</table>
Degree & Integration of MUS

20 systems studied

Example of MUS Sri Lanka Kirindi Oya

Doukkala
Badra
Zanghe
Canal St Julien
Gondorinala
Benniethora
Kirindi Oya IS
Ghotki
Accounting for water uses
Under the trees

Homestead New Irrigation System
The Hill Side

Example of negative externality related to low surface service. Naryani Terai, NEPAL

Arsenic: pumping at tail-end due to lack of irrigation canal supply generates arsenic contamination

What type of service for these other uses

• Supply water to a delivery point
• Control water presence in water stream and bodies
• Control water level in water bodies
• Maintain water quality in natural streams
• Maintain the capacity for storing water and control floods
Some critical questions about MUS

- VALUE: how to value the different functions and uses
- SERVICES: How to define the water services
- COST: How to estimate the associated cost
- EFFICIENCY: optimum of a multiple variable
- DECISION: the best decision mechanisms for MUS
- INSTITUTIONS: institutional and legal arrangements for MUS? Mechanisms to remunerate the service providers by users and beneficiaries whoever they are.

Plan for Modernization, Monitoring & Evaluation

1. Water services
2. To RAP
3. Operation improvements/units
4. Capacity & sensitivity
5. Perturbations
6. Water shares & benefits
7. Users & service to users
8. Cost of operation

Vision of the Irrigation System

THANK YOU