Training for Asian Young Professionals on
Performance Assessment of Irrigation Systems
(9th to 13th April 2018 in Beijing, China)
Performance assessment of irrigation and drainage systems - Rapid Appraisal Procedure

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Modernization to improve performance

- Irrigation performance often lower than expected and improvements are critically needed.
- Modernization a continuing process that aims to bring about improvements.

Management and operation: more complex more demanding !!

------- An urgent need to tackle complexity
- Service to users more diversified
- Water management more demanding
- Cost effective Management

Modernization

FAO 1997 Definition of Modernization:
a process of technical and managerial upgrading
(as opposed to mere rehabilitation) of irrigation schemes with the objective to improve resource utilization (labor, water, economics, environmental) and water delivery service to farms.
Service Oriented Management [SOM]
= 3 basic flows
WATER - INFORMATION - MONEY

Irrigation System Operation

➔ to produce a service to users through specific interventions on the surface infrastructure
➔ must be integrated in a context of conjunctive use of water and multiple uses of water

Why Operation and not O&M?

“... although a certain degree of coordination between operations and maintenance is important to the smooth functioning of each, ... distinctions between the two must be made”
Taylor and Wickham, 1976

Infrastructure: Specific functions

STORAGE
CONVEYANCE
DIVERSION
DISTRIBUTION
CONTROL
MEASUREMENT
SAFETY
TRANSMISSION
An irrigation system is not a spatial homogeneous body. Heterogeneity of “context-service-physical capacity” is the norm not the exception!

• Managing with the same process-targets-service-inputs is not thus sound!

• Heterogeneity is even further increasing with service oriented management (more diversified)!!

Spatial heterogeneity !!!!!

To what level should we disaggregate the service and management?

-Where should we split the management/operation?

-What is a good compromise between efficiency of organization and management (unity) and serving numerous end users with adapted services (multiplicity) ?

Dilemma ?

A command area of 30.000 ha is likely to be composed of:
1 Main canal
10 Secondary Canals (3000ha)
50 Tertiary Canals (600ha)
1000 Quaternary Canals (30 ha)
30000 farmers (1ha)

How many units should we consider for compromising between efficiency and adapted services?

This is what FAO attempts to respond from its experiences in Asia on Modernization of Canal Operation through the methodology

MAppling System & Services for Canal Operation TEchniques

MASSCOTE
Mascot: A person, animal, or object believed to bring good luck, especially one kept as the symbol of an organization such as a sports team. (Mascot came into English as a borrowing of the French word mascotte, meaning “mascot, charm.”) The American Heritage® Dictionary of the English Language: Fourth Edition. 2000

MASSCOTE Assumptions

- Focus on Canal Operation BUT Scope on Management: Canal Operation produces the service – Canal examination is critical for the appraisal (canal don’t lie)
- Service Oriented Management: the service to users is the central and only goal of MOM.
- Heterogeneity of service: based on the physical constraints, opportunities, demand for service, willingness to pay, ....
- Cost effectiveness: modernization means for each user the right service at the right cost.
- Users=payers=decision makers: Users are the clients, the beneficiaries, the payers and the decision makers
- Professionalism !!! : MOM is complex and needs skilled professionals
Embedded nature of the RAP and MASSCOTE

<table>
<thead>
<tr>
<th>Modernization Project</th>
<th>RAP</th>
<th>MASSCOTE</th>
</tr>
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<tbody>
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</table>

➢ Embedded nature of the RAP and MASSCOTE within a modernization project.
➢ Time frames
  - RAP = week;
  - MASSCOTE = month;
  - Modernization project = year.
➢ Revolving nature of MASSCOTE.
➢ Overall objective is modernization of Management.
  - MASSCOTE evolves from canal operation to management options (institutional partitioning, organization, and SOM).

What is RAP?

RAPID
  - A few days to 2 weeks

APPRaisal
  - combination of data from office and field
  - technical, managerial, socio-economic and institutional: hardware and software

PROCEDURE
  - holistic overview of performance
  - Systematic and standardized

Rationale behind RAP

• Key performance indicators from RAP help to organize perceptions and facts, and facilitate informed decisions regarding:
  - Potential for water conservation
  - Specific weaknesses in project operation, management, resources, and hardware
  - Specific modernization actions to improve project performance
Objectives of RAP

• Provide a basis for making specific recommendations for modernization and improvement of water delivery service
• Provide a baseline for comparison of future performance after modernization
• Benchmarking for comparison against other irrigation projects

Conceptual Framework

• the irrigation systems operate under a set of physical and institutional constraints and with a certain resource base.
• the systems are analyzed as a series of management levels, each level providing water delivery service through the system’s internal management and control processes to the next lower level, from the bulk water supply to the main canals down to the individual farm or field

RAP Methodology

• The process examines external inputs such as water supplies, and outputs such as water destinations (ET, surface runoff, etc.).
• It provides a systematic examination of the hardware and processes used to convey and distribute water internally to all levels within the project (from the source to the fields).

RAP Outputs

• External indicators
  – Examine inputs and outputs of the whole project
• Internal indicators
  – Examine processes and hardware within the project
• IPTRID Benchmark indicators
  – Mostly external indicators
• WB Technical indicators
External Indicators

- Ratios or percentages comparing project inputs and outputs to describe performance, for example:

  \[
  \frac{\text{Water Required}}{\text{Total Water Available}}
  \]

External Indicators

- Expressions of forms of efficiencies related to budgets, water, yields, etc. for example:

  \[
  \frac{\text{Crop Yield}}{\text{Irrigation Water Delivered to the Fields}}
  \]

Do not provide insight in how to improve performance

Internal Indicators

- Identify key factors related to water control throughout a project.
- Define level of water delivery service provided to users.
- Examine specific hardware and management techniques and processes used in the control and distribution of water.
Key findings TLBC

• Upstream of MC and SC intense rice production with high yields
• Water duty is low (460 mm per ha irrigated)
• Upstream reaches are taking more than their shares of water ➔ HIGH INEQUITY
• Cropping intensity is low (91%)
• System is physically in good shape
• Measurements not reliable ➔ Inaccuracies
• Water depth not controlled ➔ supply to tail enders is erratic

Key Findings

MULTIPLE USERS OF WATER
➢ Water is being used for drinking and domestic purposes
➢ Hydro power generation
➢ Considerable water is used for fisheries development
➢ Water is being used for recreation purpose

High Efficiency-No losses
RDS (tail end) runs dry after 1 ½ months
HIGH INEQUTY along TLBC
POOR SERVICE to TAIL ENDERS

TLBC: Main Shocks flow (cusec - white) & Water level at M104 (feet - brown)

GLBC-EXTERNAL INDICATOR

Key findings:
- GLBC is a very productive system, conjunctive use and recirculation system dominated by sugarcane
- 60 to 70% farmers have pumps
- Inequity is not related only to canal water delivery but lack of access to groundwater
- When compared to other systems, GLBC ranks high for the value per ha (1844 $/ha) or 0.23 $/m3 of water
- Without these two features or if the farmers would have followed the official cropping pattern, then the value would have been very low

Example = RAP External indic.

Output per unit service area (constant US$/ha)

BHADRA = US$ 1700/ha

Key findings:
- A very productive surface system with abundant water in wet season (Canal+Rainfall+Runoff)
- Inequity in dry season (tail-enders problems)
- Operational problems mainly along secondary canals
- Potential for savings in wet season and carry over for dry season
Internal indicators

• For services and Canals, indicators varies from HIGH (upstream reaches) to LOW at tail end

• The values are averaged for the Command Area

Service by main canal

<table>
<thead>
<tr>
<th>Actual Water Delivery Service by Main Canal to the Second Level Canals</th>
<th>Actual</th>
<th>Stated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Reliability</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Equity</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Control of flow rates to the submain as stated</td>
<td>2.5</td>
<td>3</td>
</tr>
</tbody>
</table>

Service to individual units

<table>
<thead>
<tr>
<th>Water Delivery Service to Individual Ownership Units (e.g., field or farm)</th>
<th>Actual</th>
<th>Stated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual 0.6</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Measurement of volumes</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Reliability</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Apparent equity</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
### Service by SC-Dys-Field

<table>
<thead>
<tr>
<th></th>
<th>SC to Dys</th>
<th>Dys to Sdy</th>
<th>Sdy to Field</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Water Delivery Service</strong></td>
<td>1.4</td>
<td>0.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Flexibility</td>
<td>0</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>Reliability</td>
<td>2</td>
<td>2</td>
<td>1</td>
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<td>Control of flow rates to the submain as stated</td>
<td>2.5</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

### Social order

<table>
<thead>
<tr>
<th>Social “Order” in the Canal System operated by paid employees</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree to which deliveries are NOT taken when not allowed, or at flow rates greater than allowed</td>
<td>1.3</td>
</tr>
<tr>
<td>Noticeable non-existence of unauthorized turnouts from canals.</td>
<td>0.7</td>
</tr>
<tr>
<td>Lack of vandalism of structures.</td>
<td>0.7</td>
</tr>
</tbody>
</table>

### Service to farmers (canal)

<table>
<thead>
<tr>
<th>Actual Water Delivery Service to Individual Ownership Units (e.g., field or farm)</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.0</td>
<td>1.0</td>
<td>2.0</td>
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<tr>
<td>Measurement of volumes</td>
<td>0.0</td>
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<td>Flexibility</td>
<td>2.0</td>
<td>1.0</td>
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<tr>
<td>Reliability</td>
<td>1.7</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Apparent equity</td>
<td>3.5</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
## RAP EXCEL Workbook

- A spreadsheet where key data for RAP are entered
- Spreadsheet automatically calculates external and internal indicators

## RAP Field Work

- Three days of field study
- Split in several groups
  - Ask questions to management in the office
  - Ask questions to operators in the field
  - Ask questions to WUAs
  - Ask questions to farmers
  - Observe and critically examine things

## Worksheets Within the EXCEL File

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Input – Year</td>
<td>8. Main Canal</td>
</tr>
<tr>
<td>4. External Indicators</td>
<td>9. Second Level Canals</td>
</tr>
<tr>
<td>5. Project Office Questions</td>
<td>10. Third Level Canals</td>
</tr>
<tr>
<td>6. Project Employees</td>
<td>11. Final Deliveries</td>
</tr>
<tr>
<td>7. WUA</td>
<td>12. Internal Indicators</td>
</tr>
<tr>
<td></td>
<td>13. Benchmark Indicators</td>
</tr>
<tr>
<td></td>
<td>14. WB Tech. Indicators</td>
</tr>
</tbody>
</table>
Discuss the scheme and performance in the office.

Observe the state of the canals and structures from Head Works to field level.

Observations on canals and structures.
Observations on canals and structures

**Secondary Canals**
- Discuss operations of cross regulator and inlet
- Observations on canals and structures

**Field Canals and Final Delivery Level**
- Field level observations
- Interview with farmer responsible for water distribution

**Back in Classroom**
- Do the ratings for the indicators and fill in the spreadsheets

**Back in Classroom**
- Prepare a proposal for improvement and modernization of the Scheme
Back in Classroom

Present the group’s proposal to the other groups

Sheet 5: Project Office Questions
- General project conditions
- Water supply location
- Ownership of land and water
- Currency
- Budgets
- Project operation, as described by office staff
- Stated water delivery service at various levels in the system.

Sheet 6: Project Employees
- Requests information regarding:
  - employee training
  - motivation
  - dismissal
  - work descriptions

Sheet 7: WUA
- Questions in the Project Office and interviews with WUAs on:
  - Size of WUAs
  - Strength of organization
  - Functions
  - Budgets
  - Water charges
Sheet 8: Main Canal

- Data for the Main Canal, including:
  - Control of flows
  - General canal characteristics
  - Cross regulators
  - General conditions
  - The level of service provided to the next lower level
  - Operation rules
  - Turnouts
  - Communications
  - Regulating reservoirs

Sheets 9 & 10: Second and Third Level Canals

- Sheet 9: Second Level Canals
  - Same as Main Canal
- Sheet 10: Third Level Canals
  - Same as Second Level Canals

Sheet 11: Final Deliveries:

- Information regarding the level of water delivery service to individual ownership units, and at the last point of operation by paid employees.

Sheet 12: Internal Indicators

- Summarizes internal indicators calculated in the previous worksheets
- Input regarding a few extra indicators
- Weighted category indicators are computed for groups of sub-indicators.
Sheet 13: Benchmark Indicators

• Specific data items and benchmark values that have been developed by IPTRID in 2000 for the International Benchmarking Programme (WB, FAO, IWMI, IPTRID, ITRC...)

Sheet 14: WB Tech. Indicators

• Selected indicators ... nothing new compared with external and internal indicators ... but useful if you are with a World Bank project

REFERENCES

• Rapid Appraisal Process (RAP) and Benchmarking Explanation and Tools
  http://www.fao.org/3/a-aq443e.pdf

• Rapid Appraisal Process (RAP) Excel spreadsheet
  http://www.itrc.org/reports/rapidappraisal/rapandbenchmarkingblank041803.xls

• Modernizing irrigation management – the MAISCOLE approach
  http://www.fao.org/3/a-a1114e.pdf

THANK YOU