Assessment of Modernization Needs for the Philippine National Irrigation Systems to Support High Value Crop Production

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Outline of the Presentation

1. National irrigation system
2. Rationale of the study
3. Methodology
4. Results
   - System overall and operational objectives and flow control method
   - System management and irrigation practices
   - System performance and physical capacities
   - Irrigation issues: NIA and IA perspectives
   - Potentials for HVC production/crop diversification
5. Conclusion
**National Irrigation Systems**

- Gravity-type systems, designed and operated for rice monoculture
- Government-owned and co-managed with IA
- Service area > 1,000 ha
- Serve about 933,000 ha (47%) of the total irrigated areas

**Rationale**

- **HVC production as a strategy**
  - improve farmers income
  - nutrition and self-sufficiency in major food crops
  - produce for export market
  - generate agriculture-based enterprise in rural areas
  - adapt to decreasing water supply to agriculture

- NIA adopted crop diversification as an adaptation strategy to climate change
- NIS are designed and operated for lowland rice cultivation
- Upgrading in the design, irrigation technology and operation of existing NIS

To identify key modernization needs for NIS to support diversified HVC production

**Methodology**
Methodology

- 3 case study systems
- Collection of system data
- Interviews/consultation with IA
- Interview with NIA
- System walkthrough
- Logic design analysis and MASSCOTE diagnostic tools
- Analysis of system performance and issues

Case study systems

1. Lower Chico RIS
   - Design SA: 2,000 ha
   - Firmed-up SA: 1,255 ha
   - Water source: Chico River
   - Official operation: 1979
   - Diversion: Intake barrel
   - Diversion capacity: 4.75 m³/s
   - Main canal: 6.82 km
   - 2nd canal: 30.81 km
   - No. of IA: 5
   - No. of farmers: 2,456
   - Main crop: Rice
   - Wet season: May - Sep
   - Dry season: Dec - Apr
### Case study systems

#### 2. Mainit RIS
- **Design SA:** 3,500 ha
- **Firmed-up SA:** 2,265 ha
- **Water source:** Mainit River
- **Official operation:** 1976
- **Diversion:** Ogee
- **Diversion capacity:** 4.37 m$^3$/s
- **Main canal:** 9.458 km
- **2nd canal:** 61.77 km
- **No. of IA:** 8
- **No. of farmers:** 1,894
- **Main crop:** Rice
- **Wet season:** Nov - May
- **Dry season:** Jun - Oct

#### 3. Tago RIS
- **Design SA:** 14,000 ha
- **Firmed-up SA:** 4,356 ha
- **Water source:** Tago River, Mimie Sumo-sumo
- **Official operation:** 1986
- **Diversion:** 1 Ogee, 2 barrages, 2 impoundments
- **Diversion capacity:** 24.13 m$^3$/s (Tago)
- **Main canal:** 75 km
- **2nd canal:** 73.7 km
- **No. of IA:** 22
- **No. of farmers:** 2,675
- **Main crop:** Rice
- **Wet season:** Nov - Apr
- **Dry season:** May - Oct
System objectives

• Productive irrigation
• Rice monocropping
• Dry season irrigation
• Equitable supply per ha

Operational objectives:

• **Lower Chico RIS / Tago RIS**
  • Imposed allocation to TU
  • Adjustable flow to TU
  • Rotational flow through main system
  • Upstream control
  • Direct offtaking

• **Mainit RIS**
  • Imposed allocation to TU
  • Splitted flow to TU / intermittent flow
  • Splitted flow through main system / rotational flow through main system
  • Proportional control / Upstream control

➢ There is logical coherence in the design of the system
➢ Lower low flows and intake barrel ROR are not coherent with the productive irrigation objective
Irrigation practices

- Service area is divided into management units; each is managed by its IA
  - Lower Chico RIS: 5
  - Mainit RIS: 8
  - Tago RIS: 22
- Under IMT contract
  - NIA: O&M and management of main facilities
  - IA: O&M and management of secondary facilities and structures from medium-sized lateral canals down to terminal irrigation structures
- Start of irrigation season: agreed upon by the NIA and IA
- Cropping schedules:
  - Simultaneous irrigation in Lower Chico RIS
  - Staggered, upstream to downstream in Tago RIS
  - Rotation by main canal in Mainit RIS

System performance: actual irrigated

Mainit RIS

- 5-yr range: 84-97% of FUSA
  - national average: 74-86%
- 5-yr average:
  - dry season: 92%
  - wet season: 91%
- Variations among management units

Performance: Mainit RIS

Results

Performance: Tago RIS

Results
System performance: actual irrigated

Tago RIS
- 5-yr range: 60-83% of FUSA
  ➢ national average: 74-86%
- 5-yr average:
  ➢ dry season: 71%
  ➢ wet season: 76%
- Variations among management units

Functional capacities: Present VS. Required

- Decreased functional capacity in most aspects

<table>
<thead>
<tr>
<th>Functions</th>
<th>Lower Chico RIS</th>
<th>Mainit RIS</th>
<th>Tago RIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversion (canal)</td>
<td>&lt;</td>
<td>≈</td>
<td>&lt;</td>
</tr>
<tr>
<td>Division (canal)</td>
<td>n/a</td>
<td>≤</td>
<td>n/a</td>
</tr>
<tr>
<td>Storage (canal)</td>
<td>&lt;</td>
<td>&lt;</td>
<td>&lt;</td>
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<tr>
<td>Conveyance</td>
<td>&lt;</td>
<td>≈</td>
<td>&lt;</td>
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<tr>
<td>Sediment control</td>
<td>&lt;</td>
<td>≈</td>
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<tr>
<td>Discharge transfer</td>
<td>&lt;</td>
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<td>&lt;</td>
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<tr>
<td>Water level control</td>
<td>&lt;</td>
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<td>&lt;</td>
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<tr>
<td>Flow measurement</td>
<td>&lt;</td>
<td>≈</td>
<td>&lt;</td>
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<tr>
<td>Safety</td>
<td>&lt;</td>
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<tr>
<td>Communication</td>
<td>≈</td>
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<tr>
<td>Water reuse</td>
<td>≈</td>
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<td>≈</td>
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<tr>
<td>Transport/access</td>
<td>≈</td>
<td>&lt;</td>
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</tr>
<tr>
<td>Diversion (headwork)</td>
<td>&lt;</td>
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<tr>
<td>Storage (headwork)</td>
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IA consultation
### IA consultation

#### Management unit situation

<table>
<thead>
<tr>
<th>Condition</th>
<th>Lower Chico RIS</th>
<th>Mainit RIS</th>
<th>Tago RIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet season, too much water</td>
<td>6/6</td>
<td>1/6</td>
<td>11/14</td>
</tr>
<tr>
<td>Dry season, scarce water</td>
<td>6/6</td>
<td>6/6</td>
<td>12/14</td>
</tr>
<tr>
<td>Rice monocropping</td>
<td>2/6</td>
<td>3/6</td>
<td>6/14</td>
</tr>
<tr>
<td>Whole area planted, 2 cropping</td>
<td>4/6</td>
<td>--</td>
<td>13/14</td>
</tr>
<tr>
<td>Whole area irrigated ≥ 1 cropping</td>
<td>--</td>
<td>2/6</td>
<td>--</td>
</tr>
<tr>
<td>&gt;1 coping strategy for water scarcity</td>
<td>9/13</td>
<td>6/6</td>
<td>12/14</td>
</tr>
<tr>
<td>Do-nothing on flood</td>
<td>4/6</td>
<td>--</td>
<td>13/14</td>
</tr>
<tr>
<td>Willing to diversify crops</td>
<td>5/6</td>
<td>3/6</td>
<td>12/14</td>
</tr>
</tbody>
</table>

### Results
Irrigation issues: NIA perspective

• Lower Chico RIS
  — tampering and cumbersome manual operation of the main intake gates
  — heavily scoured base of the main intake structure
  — silt-laden water supply
  — non-functional offtake gates at the Trifurcation
  — cumbersome manual operation of the big check
  — silt-laden flood water from the mountain flowing into canals
  — heavily silted drainage channels and blocked drainage outlet
  — municipal drainage discharges eroding canal walls
  — lack of backhoe and dump truck for canal dredging/desilting

Irrigation issues: NIA perspective

• Tago RIS
  — worn out, cumbersome manual operation and non-operational mechanisms of sluice and main intake gates
  — lack of critical flood water level warning device
  — damaged concrete blocks and curtain wall
  — excessive seepage at sluice gate rubber seal
  — lack of silt ejector
  — insufficient water supply during dry season
  — quarrying
  — oversized canal for the present irrigation requirement
  — excessive seepage along the main canals
  — informal settlers on main canal embankments
  — Deteriorated/non-functional flow control structures
  — inappropriate flow control structures
  — flooding exacerbated by silted and constricted natural drainage
  — lack of sufficient drainage network
  — dilapidated service roads

Desired modernization
Desired modernization by NIA and IA

- rehabilitation of damaged/non-functional physical structures
- installation/construction of additional/improved flow control structures (gated, automatic, with lock)
- dam (in Lower Chico)
- additional canals
- silt ejector
- modern flow monitoring system
- service roads
- improved drainage system
- O&M equipment (backhoe, dump truck)
- solar-powered water pumping units

Modernization need:

- Increased water storage (dam, main canal)
- Need for heterogenous approach to irrigation system modernization
- irrigation modernization to proceed in phases starting from water-scarce areas
- Control of water along the main conveyance system
- Water tanks/temporary storage upstream of HVC production
- Check gates for capture drainage water for reuse
- Solar-powered shallow tubewell irrigation
- Dredging and increased drainage density
- Filtration system for micro-irrigation (drip)
- Capacity enhancement programs for NIA and IA on O&M of modern irrigation technology

Conclusion

- TY