Innovations in Irrigation Technology
Indian Perspective

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Secretary General ICID

Innovations
• Innovations are integration of solutions developed in associated disciplines into irrigation/water management practice for solving specific set of problems, for which solutions does not exist in conventional practice.
• Considerable advancements are taking place in associated fields of ICT, IOT, Biological sciences and management/economic strategies.
• Converting a new approach into practice required repeated trials in a consistent and dispassionate manner.
• Greatest potential for innovations lie in India in rehabilitation and modernisation areas.
• New materials and techniques are needed to overcome operational constraints and changed demand scenarios.

India’s Share in World Resources
➢ Land Resources - 2.45%
➢ Renewable Water Resources - 4%
➢ Population - 18%

Water Availability

Total Precipitation
4000 BCM

Total water availability
1869 BCM

Total utilisable water resources
1123 BCM

Surface Water
690 BCM

Current utilization
450 BCM (65%)

Ground Water
433 BCM

Current utilization
243 BCM (56%)
Spatial Variation of Rainfall

<table>
<thead>
<tr>
<th>Rainfall in mm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>1,170</td>
</tr>
<tr>
<td>Max.</td>
<td>11,000</td>
</tr>
<tr>
<td>Mawsynram, Meghalaya</td>
<td></td>
</tr>
<tr>
<td>Min.</td>
<td>100</td>
</tr>
<tr>
<td>Western Rajasthan</td>
<td></td>
</tr>
</tbody>
</table>

Temporal Variation of Rainfall

Per Capita Water Availability
(National Average)

Water Availability (Cubic metre per capita per year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>5177</td>
</tr>
<tr>
<td>1991</td>
<td>2200</td>
</tr>
<tr>
<td>2001</td>
<td>1820</td>
</tr>
<tr>
<td>2011</td>
<td>1545</td>
</tr>
<tr>
<td>2025</td>
<td>1340</td>
</tr>
<tr>
<td>2050</td>
<td>1140</td>
</tr>
</tbody>
</table>

Storage position in India (BCM)

No. of Large Dams in Country = 5100

- Pre-independence: 15.6
- Present Storage: 253.4
- Under Construction: 50.9
- Under Formulation: 109.7
### Water requirement Projection

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Uses</th>
<th>Year 2025</th>
<th>Year 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Irrigation</td>
<td>611</td>
<td>807</td>
</tr>
<tr>
<td>2.</td>
<td>Domestic</td>
<td>62</td>
<td>111</td>
</tr>
<tr>
<td>3.</td>
<td>Industries</td>
<td>67</td>
<td>81</td>
</tr>
<tr>
<td>4.</td>
<td>Power</td>
<td>33</td>
<td>70</td>
</tr>
<tr>
<td>5.</td>
<td>Others</td>
<td>70</td>
<td>111</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>843</strong></td>
<td><strong>1180</strong></td>
</tr>
</tbody>
</table>

**Population Estimate:**
- 2025: 1.3 Billion
- 2050: 1.5 Billion

**Assumptions:**
- Increase in efficiency in irrigation from present level of 35% to 60% by 2050
- Increase in productivity for rainfed agriculture from 1 to 1.5 and irrigated agriculture from 3.0 to 4.0 t/ha

### Innovation areas

- Water Resource availability assessments
- Planning and design aids
- Field data collection and real time processing
- Rehabilitation strategies for structures and large structures operations in real time
- Modelling changing climate and demand scenarios and making projections
- Improving the water productivity
- Resolving disputes

### Factors Driving Innovations

- India has about 5100 large dams and innumerable small dams with ages nearing 50 years or more.
- Many of the large irrigation systems were developed by mid 1970s and need relook for restoring efficiencies.
- New claimants from urban/rural water consumption coupled with increasing industrial demands
- New developments have to work without headworks storage support and large energy footprints
- Climate change effects in terms of increasing extreme events and adaption strategies development

### Resource assessments

- Leveraging Remote Sensing technologies
- Development of India-WRIS and planning platforms, inventorisation of assets
- Assessment of water resources availability through predominantly remote sensing approach
- Assessment of capacity losses through sedimentation of reservoirs through remote sensing
Data collection

- Telemetry networks based on PRBS or TDMA based satellite communications
- Adoption of real time assessment of agro-climatic conditions in the field
- Monitoring of floods and developing conditions for possible GLOF/ natural dam breaches
- Assessment of reservoir storages available at any given time
- Forecasting and disseminating flood disaster information
- Morphological changes of important rivers in alluvial regime.

SOME EXAMPLES
Innovation Approaches

- The innovations are encouraged at all levels.
- At the expert levels, the emphasis is on establishing sustainable systems, which are easy to use.
- At the crowd sourcing levels, the emphasis is on adoption of the solution by larger community.

Integration of Innovations

- Scientific community of researchers is quite content with the demonstration of the concept.
- It is extremely important that the innovation results in a “product” or a “service” available in standard form.
- Conversion requires extensive trials and hand-holding in the initial phase.

Role of Dissemination and Capacity Building

- Success of an innovation is determined by how actively the measure is marketed.
- Large groups of interested communities have to be made aware of the availability of the solution.
- While disseminating, a keen ear to the user experiences and suggestions is a must.
- Extensive information in consumable form in a readily available form is a key requirement.
Role of Dissemination and Capacity Building

- Capacity building is the soul of the success.
- Building up of the necessary base skills before the solution is fully exposed is a must.
- Learning curve has to be smooth and has to have the acceptable levels of steepness.
- Sustained efforts on the same group with measurements of learning outcomes
- Availability of hand-holding facilities for future

Role of ICID

- ICID has a very vital role in disseminating and propagating the innovations in related fields.
- A wide variety of application areas are available through its member base for any innovation.
- Propagation of the availability of the solution with widely followed ICT means.
- Specialised programmes for disseminating to the directly involved personnel.