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International Commission on Irrigation and Drainage (ICID)

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Digital and Climate-Resilient Irrigation Modernisation

2nd Indo Global Irrigation Summit
24-25 June 2026, New Delhi India

INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE (ICID)

Smart and Climate-Resilient Irrigation System Modernisation

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Summary

Challenges Facing Irrigation Systems

Irrigation systems face pressures from climate variability, water scarcity, ageing infrastructure, and higher transparency demands.

Smart Irrigation Modernisation

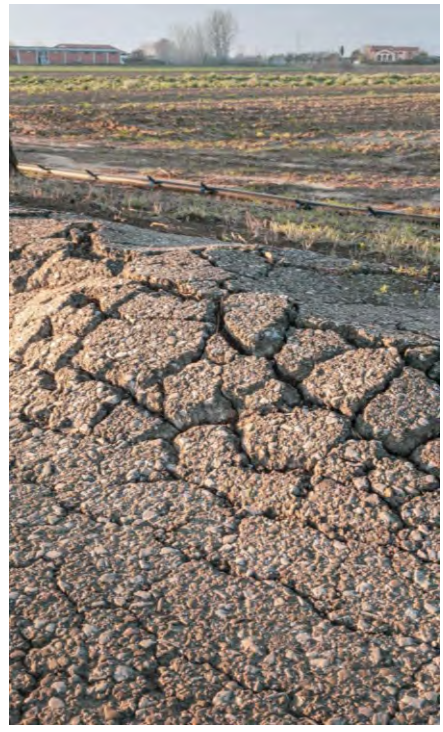
Smart irrigation involves a sequenced modernisation – **not just automation** – including measurement, decision-support, and governance frameworks.

Case Studies of Modernisation

Australia shows success with digitalisation backed by institutions; Kazakhstan needs rehab before digitalisation; India requires tailored approaches.

Context-Specific Strategies

Effective irrigation modernisation requires measurement, data systems, staged capability building, and context-specific strategies aligned with governance reforms.



Introduction and Overview

Overview of Irrigation Challenges

Challenges of Traditional Irrigation

Traditional irrigation systems rely on fixed schedules and outdated infrastructure, leading to inefficiencies and water losses.

Impact of Climate Variability

Changing rainfall patterns and declining water supply increase pressure on rigid irrigation systems to meet demand.

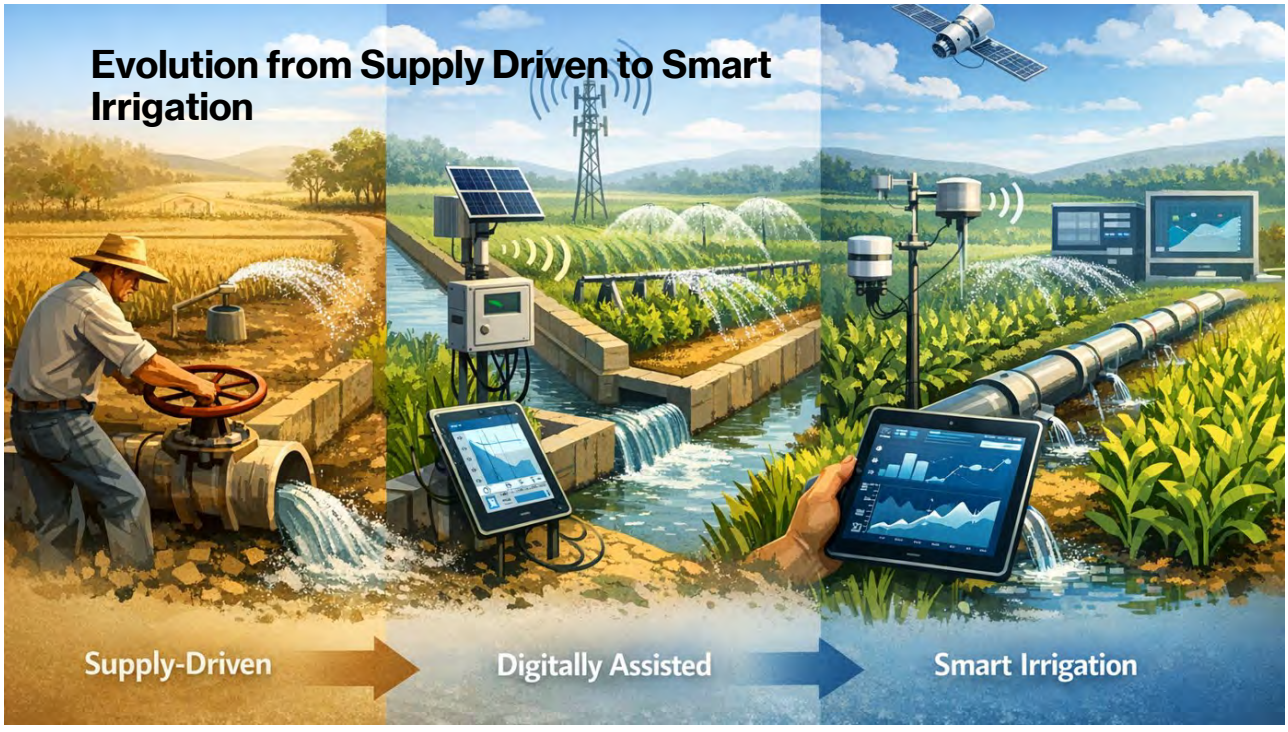
Need for Modernisation

Modernisation involves demand-responsive irrigation using digital tools, improved measurement, and governance reforms.

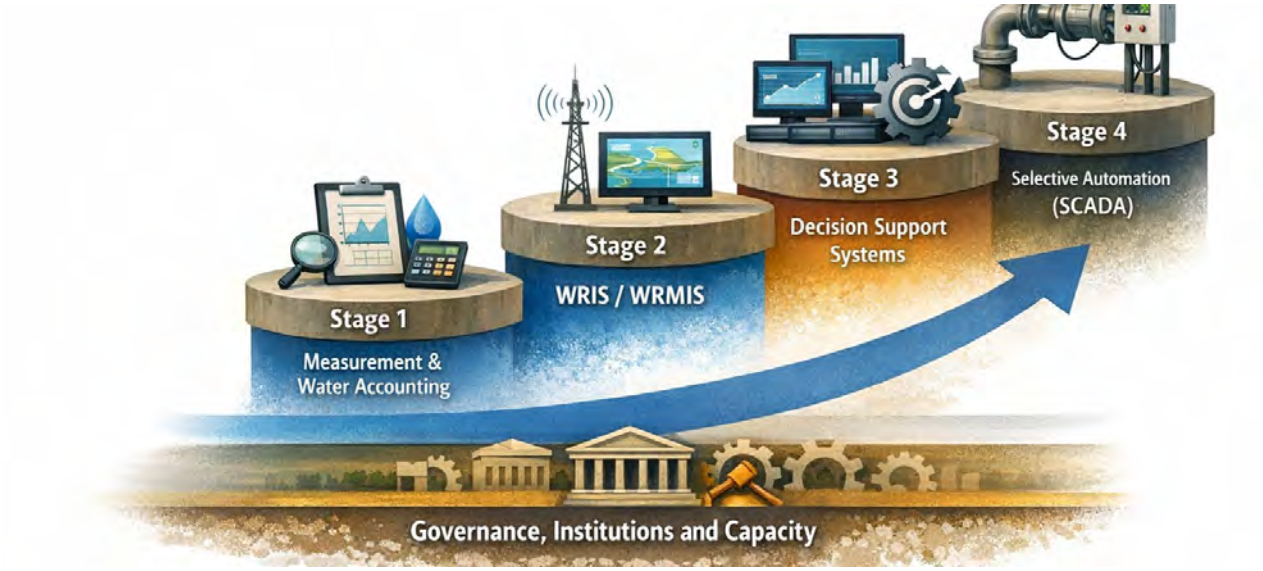
Holistic Approach to Solutions

Effective irrigation modernization requires integrating infrastructure, governance, and data systems to adapt to socio-economic contexts.

Modernisation Framework



Staged Irrigation Modernisation Pathway



Case Studies

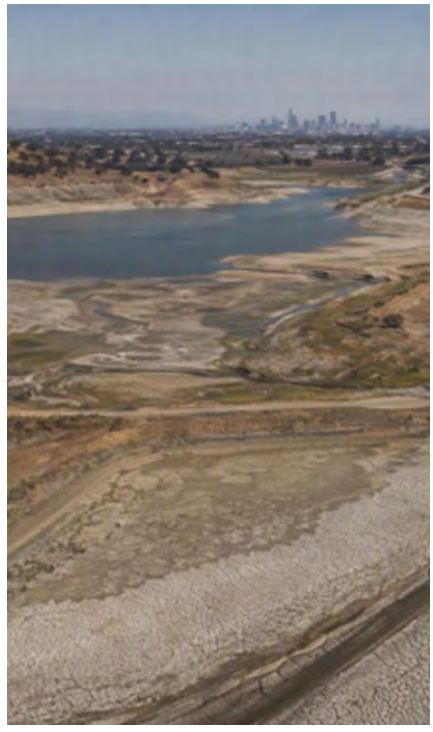
Australia Case Study

Irrigation Modernisation

Northern Victoria's Goulburn–Murray system underwent extensive modernization with automated controls and real-time monitoring.

Drought-Driven Water Investment (Australia)

- Melbourne almost ran out of water (Stage 3 and 4 water restrictions)
- Irrigation system allocations fell to 10% – only adequate for stock, domestic and high-value agriculture
- Australian governments responded by fast-tracking major investment
  - Melbourne Desalination Plant ($1 Billion)
  - North–South Pipeline ($2 Billion)
  - Irrigation infrastructure modernisation
    - Melbourne Water invested in the first phase of irrigation modernisation ($180 Million for 75 GL)
    - $2 Billion into GMW by the Australian government in exchange of water for the environment



Australia Case Study

Irrigation Modernisation

Northern Victoria's Goulburn–Murray system underwent extensive modernization with automated controls and real-time monitoring.

Integrated Water Management

Shift from local manual operations to a network-level approach enhancing demand response and climate adaptability.

Governance and Accountability

Strong governance with clear roles, transparent reporting, and robust asset management supports sustainability.

Water Savings Impact

The program achieved over 200 gigalitres of annual water savings, auditable and allocated via entitlement frameworks.

Central Asia Case Study – Kazakhstan

Aging Irrigation Systems

Kazakhstan's Soviet-era irrigation networks suffered decades of neglect, causing infrastructure degradation and high water losses of 40 to 45 percent.

Rehabilitation and Repair

The IDIP-2 project prioritised canal repairs, conveyance loss reduction, and restoring measurement and control points before digitalisation.

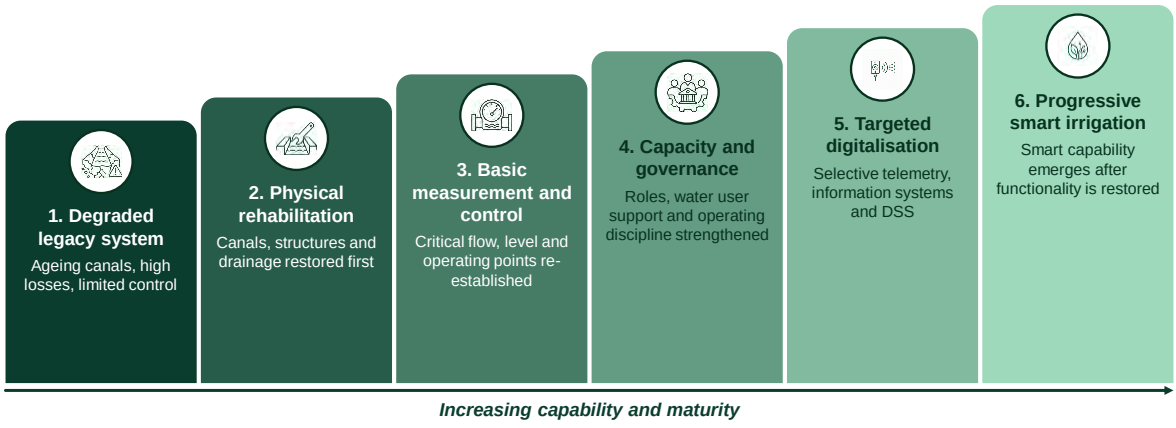
Institutional Reforms

Clarifying agency roles and strengthening water user organizations improved transparency, accountability, and irrigation management.

Phased Digitalisation

Digital tools like telemetry and data systems were introduced only after establishing foundational infrastructure and institutional capacity.

Rehabilitation Led Modernisation (Central Asia)



Comparative Analysis

Quantitative Comparison

What this means for India: With irrigation systems at mixed maturity, India's modernisation calls for investment staged to local context – not a single nationwide figure.

Metric	Australia	Kazakhstan
Total Investment	~$ 2 billion	$ 340 million
Water Savings	~200+ GL/year	~300 GL/year
System Focus	Digitalisation and accounting	Rehabilitation and efficiency recovery
Digitalisation	Advanced SCADA and DSS	Selective telemetry

Comparative Insights Across Contexts

What this means for India: Mixed maturity favours a phased, context-led path – scaling investment and digital ambition to each region's starting point rather than one nationwide program.

Dimension	Australia	Kazakhstan	India
System Maturity	Mature	Legacy – Mixed	Mixed
Primary Driver	Efficiency	Restoration & Efficiency	Resilience
Digital Maturity	Advanced	Emerging	Growing
Governance	Strong	Reforming	Developing

Smart Irrigation vs. Modernisation: The Australian Model

Modernisation has placed a lower priority on asset life and renewals than a smart-irrigation pathway requires.

The Australian Case

Existing ageing assets were modified to fit modern gates, often extending asset life by around 30 years.

A looming asset cliff: physical and digital assets – gate hardware, electronics and software – are likely to need a few billion dollars over the next 15–20 years, with funding sources still unclear.

Investment was compressed into a short ~10-year window, making it rushed rather than ideal.

It focused only on the distribution system; on-farm losses were initially overlooked and are now being addressed through other funding schemes.

Ageing assets face a looming multi-billion-dollar renewal cliff.

Staged investment building toward smart irrigation.

Staged Investment and the Case for Smart Irrigation

The Central Asia Case

Addresses two core issues at once: ageing assets and conveyance losses.

Delivers a very high return on investment.

Uses a staged, stepped investment that progressively builds toward smart irrigation.

The Broader Lesson

Recent advances in AI and data analytics expose the shortcomings of the Australian one-off investment model.

Lump-sum modernisation leaves little room for generational innovation such as AI.

Implications and Conclusions

Implications for India

Staged Modernisation Approach

India should adopt a pragmatic, phased approach to modernize irrigation systems based on local maturity and challenges.

Measurement and Data Integration

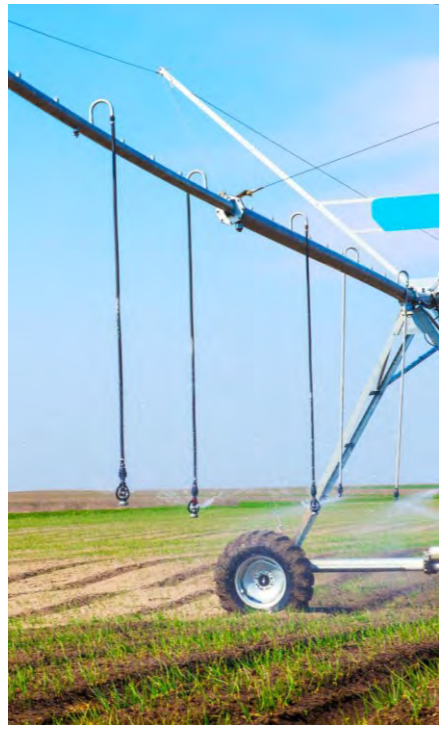
Improving water measurement and integrating WRIS and WRMIS enhances transparency and climate-responsive management.

Selective Automation and Decision Support

Automation should be selectively applied where benefits are clear, supported by decision-support systems for planning.

Governance and Capacity Building

Technology must align with governance reforms including institutional strengthening and stakeholder engagement.



Key Message and Conclusion

Integrated Smart Irrigation

Smart irrigation success depends on combining technology with measurement, governance, and institutional capacity for effectiveness.

Lessons from Australia and Kazakhstan

Australia's digitalisation benefits highlight strong regulatory frameworks; Kazakhstan shows the need for fixing capacity building.

Scalable Approach for India

India can adopt a staged modernisation aligning technology investments with system readiness and sustainable goals.

Climate-Resilient Irrigation

Achieving resilient irrigation requires coordinated efforts across technology, policy, and institutional frameworks.

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Thank You