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Rethinking Water Security, Irrigation Infrastructure and Climate-Resilient Agriculture in India

**Rajesh Sathyanarayana**Technology & Operations Executive | IP & Compliance |
Strategic Growth & Business Leadership

October 14, 2026

Are we doing enough to reduce Indian agriculture's dependence on uncertain rainfall, or have we simply accepted water insecurity as an inevitable part of farming?

Rainfall remains fundamental to Indian agriculture. Its timing, intensity, and distribution influence sowing patterns, crop selection, groundwater availability, and agricultural productivity. When rainfall is inadequate or unevenly distributed, the consequences extend beyond farms to drinking-water supplies, rural livelihoods, food security, and local economies. However, rainfall alone does not determine the severity of water scarcity. Water storage, lake and tank rejuvenation, groundwater management, irrigation infrastructure, and efficient water distribution all influence how communities prepare for drought.

What Does Irrigation Infrastructure Really Change?

Through my professional experience with irrigation projects undertaken for the Government of Karnataka, including major and minor irrigation programmes and NABARD-funded projects, I gained an appreciation of the role water infrastructure can play in addressing rural water scarcity. Some of these projects focused on replenishing lakes and tanks that had dried up during periods of drought, with the objective of improving water availability for local communities. These experiences encouraged me to look beyond infrastructure as a physical asset and consider its wider impact on people, agriculture, and the environment. A completed irrigation system or a replenished water body represents an important intervention. But what happens afterwards?

- Does it improve water availability for the intended communities?
- Does it support sustainable agricultural practices?
- Is groundwater managed responsibly?
- Are water bodies protected and infrastructure maintained over time?

Building water infrastructure and building long-term water resilience are not necessarily the same thing. The real measure of success lies in how effectively infrastructure serves communities, supports agriculture, and protects water resources over the long term.

From Water Availability to Climate-Resilient Agriculture

Reliable access to water creates opportunities for farmers, but it does not automatically guarantee better agricultural outcomes. Soil conditions, crop suitability, market demand, cultivation practices, and the long-term availability of water all matter. Sustainable irrigation must therefore go hand in hand with soil management, agricultural knowledge, and community participation. Poorly managed groundwater extraction can deplete aquifers, while water-intensive cropping patterns can increase pressure on already stressed resources. The objective should not be to maximise water consumption, but to use available water responsibly while strengthening agricultural livelihoods. Sustainable water management also has wider benefits:

- **Environmental sustainability:** Water conservation, groundwater management, and lake rejuvenation help protect natural resources and strengthen climate resilience.
- **Community well-being:** Reliable water supplies support drinking-water security, agricultural livelihoods, and rural development.
- **Infrastructure accountability:** Transparent planning, responsible resource allocation, and effective maintenance help ensure that public investments deliver lasting benefits.
- **Measurable outcomes:** Infrastructure success should be assessed through long-term environmental outcomes, social impact, and accountability—not merely the number of assets constructed.

Why Water Security and Energy Security Must Work Together

Water security is closely connected to energy security. Water must often be pumped, treated, and distributed, while agriculture depends on energy for irrigation and other operations. Solar-powered irrigation can offer opportunities to improve access to daytime power and reduce dependence on conventional electricity sources. Solar and wind energy can also contribute to a more diversified energy system. However, renewable energy alone cannot solve water scarcity. If solar-powered pumping encourages uncontrolled groundwater extraction, it may accelerate aquifer depletion.

Cleaner energy must go hand in hand with responsible water management.

The opportunity lies in integrating water-resource planning, renewable energy, sustainable agriculture, environmental protection, and effective local governance. Water resilience and energy resilience should not be treated as isolated development objectives. Their connection will become increasingly important as India addresses climate risks while supporting agricultural development and growing energy needs.

From Infrastructure Creation to Measurable Resilience

How should we evaluate investments in irrigation infrastructure and water management? Rather than measuring success only by expenditure or the number of projects completed, we should also consider whether these investments deliver lasting improvements in water security and agricultural resilience.

Depending on local conditions, relevant indicators could include:

- Water availability and reliability of irrigation supplies.
- Groundwater levels and extraction patterns.
- Agricultural outcomes and water-use efficiency.
- Environmental impacts on lakes, tanks, and catchments.
- Infrastructure maintenance and long-term operating costs.
- Equitable distribution of benefits across communities.

These indicators should be assessed against reliable baseline data and the specific objectives of each project. The principle is straightforward: **sustainable infrastructure should be evaluated by the value it continues to deliver, not merely by the assets it creates.** This approach also strengthens climate-risk management, transparent decision-making, and responsible infrastructure governance.

A Question Worth Debating

Indian agriculture will continue to depend on the monsoon. The objective is not to eliminate that dependence, but to reduce the vulnerability that arises when rainfall is inadequate, delayed, or unevenly distributed. Water infrastructure, sustainable irrigation, agricultural knowledge, community participation, and renewable energy can all contribute—but their effectiveness depends on how they are planned, implemented, and managed.

Should we measure the success of irrigation infrastructure by what we build, or by how effectively it improves long-term water security, agricultural resilience, and environmental sustainability?



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