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INSTITUTIONAL INNOVATIONS FOR IMPROVED AGRICULTURAL WATER RESOURCE MANAGEMENT IN INDIA

Amidst the rising scarcity of water resources and sub-optimal technology adoption, institutional innovations assume a key role in sustainable water management in the agriculture sector in India. S K Srivastava and Darshnaben Mahida in this blog provides an overview of the institutional arrangements and recent community-based institutional innovations adopted by different state governments for sustainably managing water resources.

CONTEXT

India is endowed with rich water resources. Agriculture is the largest consumer of fresh water, constituting about 85% of total water use. It bears prime responsibility for sustaining the dwindling water resources (Box 1). Although modern technologies such as onsite reuse, automated canal irrigation, nano-technology infiltration, smart techniques of drip and sprinkler irrigation and artificial groundwater recharge, are available in the country for efficient water management, they are primarily restricted to laboratories or limited areas.

For instance, despite having been promoted since 1991, micro-irrigation covers only about 10% of the total irrigated area in India. Moreover, the irrigation supply through canals is inefficient and faces challenges of inequitable distribution, conflicts, inadequate utilization of water potential created and environmental externalities. Since most of these challenges are embedded in the weak institutions of technology dissemination and water resources management, institutional arrangements and effective governance play a critical role in their efficient and sustainable management and also greatly influence the welfare outcomes for the rural masses.

Box 1: India's water scenario

The utilizable water resources in the country are estimated at 1,121 billion cubic meters (BCM), 73% of which is used for different purposes. Due to the burgeoning population, per capita availability of water declined from 5,178 m^3/year in 1951 to 1,441 m^3/year in 2015, which is lower than the water-stressed norm of 1,700 m^3/year. Further, there are wide regional and seasonal variations in water availability in the country. On the other hand, the demand for water has been growing due to rising economic activities, an inclination toward water-intensive food habits and lifestyles, rapid urbanization, etc. This rising demand is expected to exceed the utilizable supply, and several parts of the country have started witnessing water scarcity. Presently, about 60% of the Indian population has access to less water than the scarcity threshold of 1,000 m^3. Climate change is expected to further aggravate the scarcity of water resources, underlining the dire need to sustainably manage water resources through improvised policies, vigilant implementation, awareness, and accessibility to advanced technologies, institutional innovations and effective governance.

WATER INSTITUTIONS IN INDIA

Conceptually, institutions are defined as "humanly devised constraints that shape the human interactions" (North, D.C. 1990). Institutional arrangements help define the operational rules and regulations describing the relationship between co-users and between users and the natural resource, water in this case. The institutional structure governing water has three major dimensions, i.e., water policy, water law and water administration (Box 2).

Box 2: Institutional structure governing waterater

Policies are the broad guidelines and intended approaches stated by the state and central governments for decision-making in water management. Laws are legally enforced rules binding on the parties or individuals concerned. According to Saleth and Dinar (2004), law and policy need reciprocal revisions over time for improvisation and implementation. The Indian water policy evolved from the National Water Policy in 1987 by the National Water Resource Council (NWRC), and has since been revised in 2002 and 2012. It mainly covers cost recovery, project selection criterion, water pricing policy and participation and privatization. The water laws in the country include legal provisions in the form of constitutional provisions, irrigation acts, central and state-specific laws, customary law and penal codes and criminal procedures. To ensure legal uniformity and proper management of water resources across the states, a draft National Water Framework Law has been prepared by the central government. It embraces facets of water rights, inter-governmental responsibility and regulatory and accountability mechanisms. The administrative component of water institutions is basically an execution of water-related laws and policies.

The Indian Constitution extends a superior role to states in the management of water resources. The central government is entrusted with formulating model policies and laws, resolving inter-state water disputes and sponsoring water-related infrastructure and schemes. The final legislative power to the states often leads to legal and administrative issues such as poor integration of central and state level water policies, fragmented administrative and management power to multiple ministries and departments dealing with water, inadequate implementation of policy recommendations by the states, intractable inter-state disputes, etc.

The administrative structure of water institutions at the state level comprises of regulatory authorities, water/irrigation departments, the Panchayat Raj system and Public Works Department for the storage, supply and distribution of water. Policy formulation, administration and mobilization of water in coordination with the center are carried out by the upper level of administrative hierarchy, while implementation, monitoring and maintenance are performed by the three-tiered Panchayat Raj system in rural areas and by the district and municipalities in urban areas (Ahmed and Araral 2019). At field level, various institutions are involved in distributing the irrigation water from canal/surface water bodies/groundwater sources to the farmers' field. These institutions are either formal institutions managed by public or local communities such as warabandi system, water users' association, government wells, etc or informal institutions such as groundwater market, private wells, etc. These institutions are intended to ensure equity and efficiency in water distribution and usage.

Recent community-based institutional innovations

Community-based institutional innovations in water management can be seen as people coming together to address their local water-related issues. Local communities are the best guide to manage their local resources and hence, it demands awareness and empowerment among them to understand and resolve their local challenges. Experience has shown that civil society initiatives and organizations have a vital role to play in facilitating community participation. They do so by enabling the evolution and development of community-based water management models which are economically and ecologically more viable. A few recent community-led initiatives by different state governments for effectively managing scarce water resources in agriculture are presented in Table 1.

Table 1: Community-based institutional innovations for managing water resources in agriculture in different states of India.

Place	Objective	Interventions	Outcomes
Maharashtra (initiated in 2017)	Desilting waterbodies to restore water storage capacity and improve percolation potential under the" "Gaalmukt Dharan and Gaalyukt Shivar" (GDGS) scheme	- Excavation machines were hired by community contributions or by the source of humanitarian funding - The fuel cost to run the machine for excavation was borne by the government - Farmers could have silt free of cost (carting it at their own expense)	- Till 2021, 5,270 waterbodies were desilted, increasing the water storage capacity by about 32,300 thousand M^3 - Excavated silt was spread across more than 54,000 acres benefitting over 6.4 million farmers by improving farm productivity by 2-4 times
Chhattisgarh (Uttar Bastar Kanker district) (2018)	A water sufficient and poverty-free gram panchayat and to ensure women's education and participatory planning in watershed management (NITI Aayog 2021)	- Trainings and visits were conducted with the active participation of village organizations and SHGs - Social and resource mapping and livelihood-focused planning - Communities were linked to government schemes	- Farm ponds were deepened to ensure water availability for longer periods - Fishery emerged as a new source of livelihood - Shift in cropping pattern toward vegetables - Higher yield and production of paddy
Andhra Pradesh and Telangana (2011-13)	To bring farmers together for a sustainable model of water sharing and groundwater management by using shared networks of borewell pooling	- Identification of farmers with borewells and building a collective of borewell owners and non-owners - Establish norms and capacity building to map aquifers, borewell and rainfed areas and hydrogeology training - Formulation of groundwater sharing norms and a system for their enforcement and maintenance - Mapping of agricultural land and connecting borewells to design a borewell network - Promotion of soil conservation practices	- Rise in groundwater level which reduced pumping time and increased water availability - Soil conservation together with micro-irrigation practices improved crop productivity, improved livelihood and reduced migration
Jharkhand (2017)	Installation of Solar Power Lift Irrigation System (SPLIS) through community led-co-investment (supported by Syngenta Foundation of India) to ensure	- Farmer collectives bore 40% of the total capital cost and provided human resources for installation and the remaining 60% of the cost was contributed by SFI	- Increased area under irrigation - Shift in area under rice to vegetables and fruits - Increased income and enhanced lifestyle of the farmers

	higher conveyance efficiency by reducing seepage loss (CGIAR 2020)	- Ownership of the pump to all those who paid for it - SFI provided technical guidance and support in laying the pipeline for the water supply system for pumping and distributing water from the nearby river - Aftercare and maintenance was managed by the community	- Many children moved to private schools seeking better education
Madhya Pradesh (Betul district) (2017)	SHG initiative to increase access to clean, reliable and cheap energy sources through portable solar powered irrigation systems (SPIS) via Custom Hiring Centers (CHCs)	- SPIS owned and managed by CHCs were operated by women SHGs with the support of BAIF development research foundation - 20% of the capital cost was borne by SHGs and the rest by SFI - Renting out portable pumps at the rate of Rs. 50 per day for drinking and irrigation	- The mean earnings of all the five groups formed for the Rabi season 2018-19 was Rs. 2,000 and Rs. 1800 for irrigation and drinking purposes, respectively - Small farmers have increased accessibility to power and can afford it

Undoubtedly, technology plays a critical role in addressing water-related issues, but water being a social good, civic participation becomes equally important to guarantee access and equity to water resources. Although existing water policies explicitly mention the involvement of local communities in water management, its adoption and performance vary greatly across regions due to various socio, cultural and political factors.

CONCLUSION

India has multi-tier and complex institutional arrangements for managing its water resources. Although their roles are clearly defined, a multitude of challenges and poor integration among the institutions often lead to sub-optimal management of scarce water resources. There is large-scale inefficiency in the distribution of irrigation water to farmers. Transferring the distribution and management of water to local communities has been recognized as a major institutional intervention in existing water policies. But the wide inter-regional variation in the adoption of community-led institutions (e.g., water users' associations) and their performance necessitate a deep understanding of the social dynamics and community behaviour. Among others, the application of tools of behavioral experiments can be leveraged to develop and mobilize community institutions to address emerging water management issues. Further, successful models developed in different parts of the country need to be evaluated and promoted in other regions with similar agro-ecological and socio-cultural conditions.

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