Groundwater Governance Issues in Irrigation Development – A Perspective

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INTRODUCTION

Irrigated agriculture is fundamental to Indian economy, particularly, from poverty alleviation point of view. Agriculture alone accounts for nearly 30 per cent of GDP and 70 per cent of employment in the country. Irrigation is a primary input to agricultural production. With the rapid expansion of irrigation in terms of commissioning of major, medium and minor irrigation projects through various five-year plans, the potential created has grown manifold since 1951. This has resulted in India moving from the spectre of periodic famine and import of food grains to the actuality of achieving self sufficiency in food and drought proofing, besides exporting select food and horticulture crops. With ever increasing population, however, India would be required to feed about 1.40 billion people by 2025. The current food production of nearly 210 million metric tons will therefore have to be raised to 350 million metric tons by then. At the same time, there will be an increasing pressure to diversify the agricultural output by raising high value crops, such as, cash crops, horticultural crops etc., so as to give further boost to the rural economy in terms of generation of higher rural income and employment. Hence, judicious use of water under irrigated agriculture with strong emphasis on water management in terms of water conservation and augmentation of both the surface and the groundwater resources of the country is most important.

Water Resources of India

The utilisable water resources of India are estimated at 1133 billion cubic metre (BCM) which includes 690 BCM of surface water and 433 BCM of groundwater. It is however possible to augment additional surface water resources up to 240 BCM through inter basin transfer. Out of the available utilisable resources, only 605 BCM are presently utilized, of which irrigation accounts for nearly 500 BCM, Domestic use for 30 BCM, industry for 20 BCM, energy for 20 BCM and other uses account for balance 35 BCM. Thus, irrigation alone constitutes about 80 per cent of the total utilised water resources of the country. However, this comfortable position would not continue in future because of competing demands from other sectors, particularly drinking water requirements, since prioritized under National Water Policy.

Therefore, future planning for expansion of agriculture/irrigation would not have the luxury of unrestricted water availability and one has to proceed differently on a natural resource management concept, if only to set the path for a second green revolution of food sufficiency and high marketable surpluses.

Although surface and ground water are inter-related resources, this paper will focus mainly on the groundwater governance issues. Let us begin by looking at the status of physical progress in this regard.

PROGRESS OF GROUNDWATER DEVELOPMENT

Our country started with big publicly owned surface irrigation systems. However, over the past two-three decades, the major expansion in irrigation capacity has taken place in the private groundwater irrigation and ground water has been the life line for agriculture specially during this period.

Number of Structures

As per the latest 3rd Minor Irrigation Census (as of 2000-01) the number of minor irrigation structures existing in the country are as below.

(in thousand nos.)

Region	*Ground water*				*Surface water**		
	Dugwell	*Shallow Tubewell*	*Deep Tubewell*	*Sub total*	*Lift*	*Flow*	*Sub total*
North	1,197.6	1,570.8	92.1	2,860.5	5.6	25.7	31.3
North East	10.3	80	0.9	91.2	3.2	47.4	50.6
East	876.5	1,300	15.9	2,192.4	157	148.6	305.6
Central	1,606.9	3,943.2	77.6	5,627.7	228.8	140	368.8
West	2,599.8	112.6	171.4	2,883.8	104.1	90.3	194.4
South	3,335.7	1,349	172	4,856.7	108.1	189.9	298
Total	9,626.8	8,355.6	529.9	**18,512.3**	606.8	641.9	1,248.7

*irrigation tanks included here

(*North:* J&K, HP, Punjab, Haryana, Rajasthan, Delhi, Chandigarh; *North East:* Arunachal, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura; *East:* Bihar, Jharkhand, Orissa, West Bengal, Sikkim, A&N Island; *Central:* MP, Chhattisgarh, UP, Uttaranchal; *West:* Gujarat, Maharashtra, Goa, Dadra & Nagar Haveli; *South:* AP, Karnataka, Kerala, Tamilnadu, Lakhadweep, Pondicherry)

It may be recalled here that groundwater irrigation structures almost entirely fall in the minor irrigation category. Thus we see that there are as many as around 18.5 million groundwater structures as of now—a big governance challenge.

Area Irrigated

The irrigated area, which increased handsomely over the years, contributed in no small measure by the expansion of groundwater irrigation. The current estimated position is as follows:

(in mha)

	Major/Medium Sub-sector	*Minor irrigation Sub-sector*			*Grand Total*
		Surface Water	*Ground Water*	*Sub Total*	
Ultimate Potential available	58.5	17.4	64.05	81.45	139.95
Potential created	32.69	12.24	45.88	58.12	90.81
Potential utilised	28.20	10.82	42.05	52.87	81.07

The gap between ultimate potential, potential created and potential utilised points to the need for better governance which can stimulate efficient utilisation, to the maximum extent, of the potential available.

Credit Flow

The flow of credit to minor irrigation sector of which more than 90 per cent is accounted from ground water over the years, is as below.

(in Rs. crores)

Year	*Ground Level Credit*
IX Plan	
1997-98	1,584
1998-99	1,856
1999-00	2,132
2000-01	1,820
2001-02	1,845
X Plan	
2002-03	1,975
2003-04	2,730
2004-05	4,214

It may be noted that this credit as well as that over earlier years, has mainly flown to the private groundwater sector through structures owned by farmers. However, as a percentage of the total number of private groundwater structures created, it is estimated not to cover more than 30% of them, i.e. a major portion of groundwater irrigation has been self-financed by the farmers, and it is this category which has been almost entirely ungoverned.

GW Available for Future Irrigation Development

Recently, the assessment of the dynamic groundwater resources of the country was completed (March 2004) whose summary is given below.

Region	*Net Annual ground water available for future irrigation development (in million ha.m/year)*
North	-1.27
North East	4.12
East	3.64
Central	4.84
West	1.84
South	3.03
Total	16.2

This shows that as of March 2004, there are 16.2 million hectare metre of dynamic groundwater resources available in the country for future irrigation development which, however, are very unevenly distributed in the different regions. The Western and Northern regions have low groundwater availability and the assessment units are mostly categorised as critical and over-exploited, which denote areas to be regulated for future use.

Status of Groundwater Use

The trend of block categorization—increase in the numbers of 'unsafe' (semi-critical, critical and over-exploited) blocks—over the last 15 years (1992-2005) is indicated in the table below, which shows the fast depletion of resources.

Block Categorisation within the 'unsafe' category	*Position as in*		
	January 1992	**April 1998**	**August 2005**
Over-exploited	-	-	839
Critical/Dark	309	416	226
Subtotal	**309**	**416**	**1,065**
Semi-critical/grey	16	448	550
Total	**325**	**864**	**1,615**

Thus, we see the situation is fast deteriorating and urgent steps are required. Sound governance is the single most important necessity in this direction.

GOVERNANCE

The term governance deals with the processes and systems by which an organisation or society operates. The World Bank defines governance as "the exercise of political authority and the use of institutional resources to manage society's problems and affairs". An alternative definition suggests that governance is "the use of institutions, structures of authority and even collaboration to allocate resources and coordinate or control activity in society or the economy". Thus, governance can be taken to be broadly synonymous with authority, decision making, power, administration, or politics.

However, more specifically, we shall take governance to mean two broad things—Rules and Institutions/Agencies.

Rules

Rules are the agreed sets of behaviour to be complied by the whole society. There can be formal rules in the shape of Constitution, various legislations, bye-laws, customary laws, case laws, etc., and there can be informal rules in the form of social consensus/wisdom, which although not codified, have some force for compliance by individuals, and tend to become codified over the years.

The rules existing in the water sector are: Constitutional entries in the Union/State lists, Inter State Water Dispute Act, some State Water Acts, WUA Acts, Easement Act, etc.

Institutions/Agencies

Then there are the institutions to operate those rules (the executive), and to change those rules as and when required in a dynamic world (the legislature), and to adjudicate (the judiciary). Thus we have the Government, the Parliament and the Courts, at the Central, State and Panchayat levels, besides which there are institutions operating exclusively in the water sector e.g. the Water Disputes Tribunals, WUAs, Water Resource Regulators in some states.

The objective of this entire process of governance—the rules and the institutions—is to bring about efficiency, equity and sustainability of resources.

Efficiency

Efficiency or productivity is the quantum of output per unit of resource. In the irrigation sector, it would mean more crop per drop and no wastage/over-use.

Equity

Equity in allocation of natural resources means that the benefits of using them are distributed fairly. In an operational and restricted (human rights) sense, it would mean that everybody has access to water at least as per their minimum needs.

Sustainability

This is about meeting the needs of the present generation without harming the prospects of the future generation. This may require curtailment of the present levels of consumption of the resources. An example of this is the current restrictions on the groundwater use to the annually rechargeable dynamic resources.

GROUNDWATER GOVERNANCE—RULES AND INSTITUTIONS

In the backdrop of the above, let us see what is the position in the groundwater sector and what more needs to be done.

Technical Issues for Governance

The major development of irrigation capacity in the private sector over the years, as indicated earlier, has been groundwater-based and a portion of the same has been possible through bank finance, supported by NABARD refinance. NABARD used its position to promote efficiency, equity, sustainability and also to direct irrigation development in areas with abundant groundwater resources, through its mandatory norms of refinance that the banks have to follow for availing it. Some of these norms are given in following paragraphs.

Norms for NABARD Refinance

Groundwater Availability

The first requirement for judicious use of any resource is its accurate assessment to define availability on a sustainable basis. Unless quantum of resource available is known its development strategy cannot be successfully planned. In this direction, NABARD (including previously, ARDC) alongwith CGWB and State Ground Water Departments have played a crucial role in initiating the exercise/process of groundwater assessment, since 1972 (JK Jain Committee), 1979 (Over-Exploitation Committee), 1984 (Groundwater Estimation Committee/GEC-I), 1997 (GEC-II) and 2004 (Hard Rock Committee). These methodologies were applied to assess the dynamic groundwater resources in the country.

An R&D Advisory Committee constituted by CGWB is presently working on the quantitative assessment of groundwater resources of phreatic and confined aquifers. However, there is further need to establish Aquifer Boards (an institution) on the lines of the River Boards for better aquiferwise assessment, planning strategy of utilisation and monitoring the stage of development of groundwater resources in various aquifers.

Block Categorisation

Categorisation on the basis of stage of groundwater development and long term trend of groundwater table has been carried out at block level for the whole country and was intimated to the banks and state governments for directing their finance in this sector. As per the present policy, NABARD refinances only for new groundwater structures in safe and semi-critical blocks. All the Centrally sponsored and Public Sector subsidy linked credit assistance for groundwater development are governed by NABARD on the basis of categorisation of assessment units.

Spacing Norms

To ensure that the extraction from one groundwater extraction structure does not affect the adjacent one, minimum distance between two groundwater extraction structures has also been prescribed as spacing criteria, based on the hydrogeological characteristics of the area.

Quality of Pumpsets/Energy Efficiency

Based on 'Pilot project studies for quality control of agricultural pumpsets' taken up in 18 States, two publications have been brought out, spelling out a matrix for selection of lifting devices for groundwater abstraction, depending on crop water requirement and total head for irrigating the designed command area from various groundwater abstraction structures (DW, STW, TW, BW, etc.). Further, the matrix details have been taken up with Bureau of Indian Standards (BIS) and IS 10804-1994 for 'complete pumping system (CPS), for quality control of agricultural pumpsets was formulated for selection, installation, operation and quality control of agricultural pumpsets for optimum efficiency. CPS was made mandatory for NABARD refinance for pumpsets financing by banks. Necessary certification from authorised manufacturers/dealers have been made mandatory including certification from the financing banks.

However, the ground reality is that the above mentioned guidelines and set norms are often ignored. Inefficient lifting devices like air compessors, piston pumps, which even resort to surging of water, are also being used widely. Such practices lead to over-exploitation of the aquifers and disturb their

hydraulic efficiency. It is being realized that energy for agricultural operations is one of the reasons behind it. Farmers are not bothered about energy efficiency. A scheme formulated by NABARD for rectification of agricultural pumpsets has also not been successful because of this reason. This is a very serious governance issue.

Reforms are possible by increasing energy-efficiency through the process of giving grant for more efficient pumps and systems improvement, and removing subsidies on energy (i.e., power charges to be increased). With such practices, the farmer's payout for electricity may still remain the same on account of decreased energy consumption. Thus, power reforms can facilitate water reform in the groundwater sector.

Use of imported low-cost pumps with very high specific speed and high specific fuel consumption can also increase quantity of economical lifting of ground water. NABARD is taking up the issue with BIS for their standardisation and certification. Large-scale use of such pumps which are mainly imported from China, has been reported in Eastern and North Eastern States.

Crop Water Based Design

Crop water requirement based design of structures and lifting devices are promoted by NABARD for various hydrogeological units for the peak requirement period (rabi crop) to ensure sustainability and financing banks advised of various crop commands.

Information Dissemination

As indicated earlier, optimisation matrix was prescribed for selection of agricultural pumpsets based on design discharge, total head and pipe diameter (mandated velocity of flow to bring friction losses within 10% of the overall length of piping system). State Level Technical Committees have been constituted under Agricultural Production Commissioners in the states to short list the type, brand and average costs of efficient lifting devices, essential accessories and protective devices covered under IS-10804-94.

The above rules/prescriptions were created in the past to direct the flow of credit appropriately. However, nowadays banks are financing the irrigation structures out of their own resources, or the farmer has been self financing, often disregarding these norms, resulting in a substantially ungoverned and subsequently over-exploited groundwater sector. This situation calls for making these norms a part of the state legislations for better compliance.

Other Technical Issues

Certain wise strategies/technical best practices are being promoted in a big way these days. These have not yet become laws, but are similar to the Directive Principles of State Policy of the Indian Constitution in the sense that they are desirable prescriptions but, cannot be enforced through a Court of Law. There have been cases of healthy judicial activism off late which have been supportive of such causes. It is suggested that some of these may have to be brought to the realm of governance, i.e., rules/laws/legislations may have to be formulated, to give them greater force for compliance.

Micro Irrigation

Drip and sprinkler irrigation systems besides contributing to water conservation and management, also enhance the crop productivity and, therefore, need to be made mandatory in groundwater scarce (over-

explioted/critical) blocks, or for water intensive crops like sugarcane in all areas. Quality control as per criteria laid by Bureau of Indian Standards (BIS) have been made mandatory for credit assistance.

Further, a variety of low cost innovative micro irrigation systems are being widely used by the farmers, for which the issues of quality standards and certification systems need to be settled. NABARD is taking up the issue with BIS, as this will promote water conservation and management and make it affordable to even small and marginal farmers.

Rain Water Harvesting/Artificial Recharge

In view of the depletion of groundwater resources and continuous decline of water levels, water harvesting techniques feasible for various physiographic and hydrogeological regimes has to be an integral part of the management practices in critical and over-exploited areas.

Cropping Pattern

A cropping pattern appropriate for the available water resources in the area may be suggested and public awareness created for its adoption by the extension wing of the State Agricultural Departments, Krishi Vigyan Kendras and ICAR institutes as an indirect governance for conservation and management.

Integrated Water Resource Management (IWRM)

IWRM planning including conjuctive use may be incorporated in the development plan of all completed surface irrigation projects under participatory irrigation management (PIM) as a governance strategy for equitable distribution and warding off against water-logging and salinisation in command areas.

Coastal Aquifers

As per the existing regulations, only single phase pumping structures are permitted within a narrow belt from the coastlines for domestic use, and pumped irrigation from ground water is restricted for a distance of 2 km and 10 km respectively from the coastline in West and East Coast. However, groundwater abstraction structures have been constructed upto a distance of 5 km from coastline which leads to sea water ingress. Regulation needs to be strengthened to take care of such situation.

Economic Aspects of Governance

Property Rights

Scarce resources become economic resources and ground water in India has been increasingly becoming scarce. Property rights are generally integral issue in governing economic resources. Market systems based on property rights combined with competitive voluntary exchange are widely believed to bring about efficiency of the resource use. These rights are classified into four broad management systems called property regimes, that allow us to expect certain kind of behaviour from other members of the society about their rights and duties pertaining to the resource and smoothen their use and exchange. These four regimes are private property, state property, common property and open access (or, nobody's) property.

Ground water is generally regarded to be in the open access regime, i.e., anybody can extract as much water as he wants from the ground below, i.e., unlimited rights and no rules. This situation is

believed to be one of the major reasons for over-exploitation of resource, i.e., the tragedy of the commons starts operating. This has to be set right, i.e., the property regime has to be changed from open access to community/state, if not to complete private property regime. This would require a legislation by the state.

A suggestion to be debated in this regard is for creating a system of entitlements. Firstly, there can be a Minimum Entitlement of a certain quantum of water for all citizens, mainly for domestic use (based on the human rights concept). This would be available irrespective of land ownership, and it would be the duty of the State to make it available to all citizens at nominal cost/free. Beyond this Minimum Entitlement, some Additional Entitlement (in the sense of private water rights) may be given to the existing/traditional users of water as per their current usage and frozen at that level. Both these entitlements should be tradeable in the market. Beyond these entitlements, all the water would be owned by the state and auctioned in large numbers of smaller aquifer blocks/modules to private highest bidders for a specified leased period as done in the case of awarding of oil-field contracts. It is hoped that the market trading of entitlements and private sector competition would bring in efficiency. The equity would be taken care of by the entitlements and sustainability, by state/community ownership and a regulator (an institution).

Water Pricing

Pricing depends on the kind of property regime in force. It is suggested that after putting in place the property regime as suggested above, all water may be allowed to be priced by their owners as per the play of free market forces of demand and supply. Currently, some small groundwater markets do exist in Western (Gujarat, Maharashtra) and Eastern (Bihar/West Bengal) regions.

The above system of governance looks a bit elaborate and cumbersome, involving elements of human rights, as well as private and state property regimes. But this is understandable in view of the fact that water is a basic human need, besides being a scarce economic good. The new system may have substantial transaction costs and putting in place an institutional framework for the same also may be difficult. But, it is to be realized that merely the existence of a set of laws, even with tardy implementation, acts as a deterrent for abuse and as a promoter of wise acts; it is better than no laws as is the case now.

A pilot project on experimental basis is suggested to be taken up for establishing the property regime as indicated above and future policy may be decided on the basis of the learnings.

Financial Incentives

Another economic approach—an alternative to the property rights approach indicated earlier, specially in the area of pollution abatement—is the system of taxes/subsidies and marketable permits (analogous to the Clean Development Mechanisms). Some of these systems are already in place e.g. subsidy for clean and conserving technologies (e.g. micro irrigation). A suggestion in this direction is to put in place, higher taxes for higher HP submersible pumpsets which are responsible for groundwater depletion in a big way.

Overall, an appropriate combination of all the approaches outlined above— regulatory, as well as market-oriented (property rights, and incentives)—may work best and would be more practical to implement.

Other Economic Issues

Besides the foregoing, the following miscellaneous issues also require attention for governance.

Insurance for Well failures

Lot of well failures take place in hard rock areas putting the farmers to debt trap in the absence of insurance facilities. Financial incentives in the shape of higher insurance premium, budgetary support may have to be put in place to attract the insurance companies and banks to offer services in this sector. Compensation scheme for failed wells with 50:50 per cent Central and State government contribution, has been dispensed with for more than a decade.

Reuse of Treated Water

Large scale reuse of treated water from urban and semi-urban sewage and industrial effluents need to be promoted for irrigation as per appropriate quality standards, alongwith financial incentives, and pricing for suitable crops as practiced widely in developed countries to govern scarcity areas.

SUM UP

This paper has suggested certain experimental changes in the rules (technical and economic) and institutions governing the groundwater use in the country. Comprehensive institutional mechanism and regulations alongwith market-oriented approaches would have to be put in place by the Central and State governments for governance of groundwater use in the country to ensure equitable and sustainable water availability for future domestic, agricultural and industrial uses.