EUROPEAN UNION STATE
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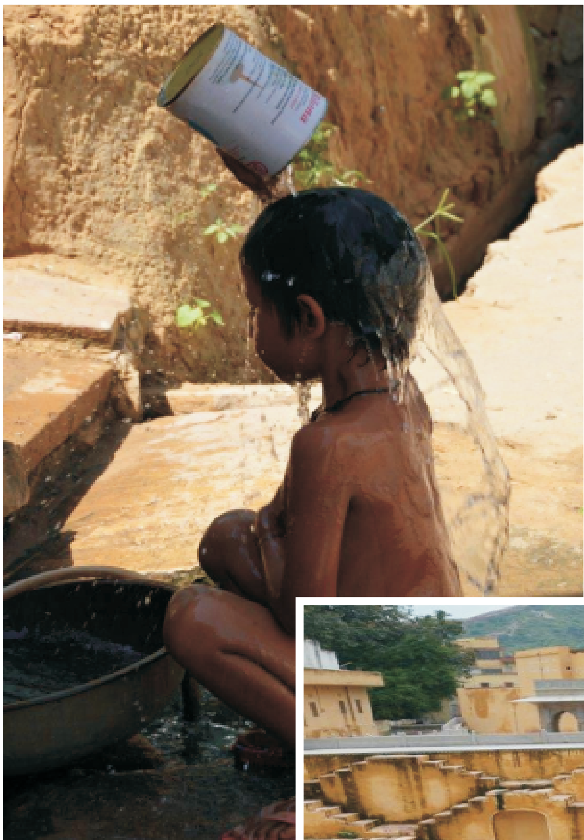
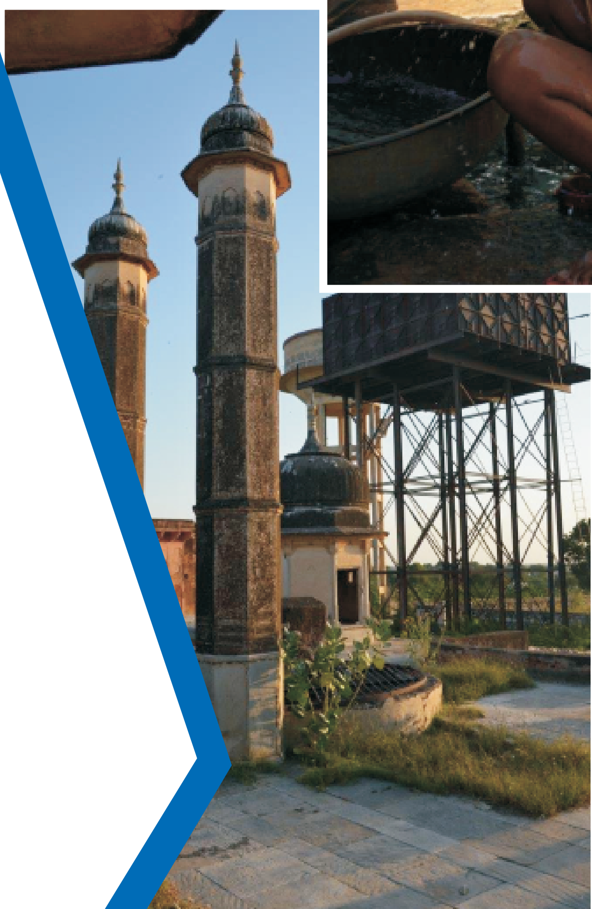
## Rajasthan Study 4

# REGULATING WATER DEMAND AND USE IN RAJASTHAN





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## Rajasthan Study 4

# REGULATING WATER DEMAND AND USE IN RAJASTHAN

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# CONTENTS

# ACRONYMS

| | |
|---|---|
| ACWADAM | Advanced Centre for Water Resources Development and Management |
| AP | Andhra Pradesh |
| APFAMGS | Andhra Pradesh Farmer-managed Groundwater Systems Project |
| BCM | Billion cubic metres (of water) |
| CAD | Command Area Development |
| CGWB | Central Ground Water board |
| CWS | Centre for World Solidarity |
| GoI | Government of India |
| GoR | Government of Rajasthan |
| IRA | Independent Regularity Agency (or Authority) |
| JGS | Jyoti Gram Service |
| MP | Madhya Pradesh |
| NABARD | National Bank for Rural Development |
| NGO | Non-government Organisation |
| O&M | Operation and Maintenance |
| SEB | State Electricity Board |
| SWP | State Water Policy |
| SWPAP | State Water Policy Action Plan |
| SPP | State Partnership Programme |
| WCT | Water Conservation Technology (or Water Saving Technology) |
| WRA | Water Regulatory Authority |
| WUA | Water User Association |

# EXECUTIVE SUMMARY

Rajasthan's 2010 State Water Policy (SWP) recognises that increasing water scarcity is a result of an imbalance between available water resources and rapidly escalating water demand. The policy also recognises that water pollution from natural contaminants (e.g. fluoride) and anthropogenic contaminants (e.g. untreated wastewaters) is widening the gap between demand and available water resources of an acceptable quality. Significantly the policy acknowledges that as water scarcity increases, it is the poor and marginal social groups who tend to suffer the greatest hardship.

Increasing water scarcity in Rajasthan has created pressures and incentives for major policy change. As a consequence, the SWP signals a shift of emphasis from engineering solutions aimed at augmenting supply to solutions based on regulating demand and maximising the beneficial and equitable use of available water resources. Regulation and demand management are threads that run through the SWP and associated action plan. The stated aims of regulation and demand management are: to restore the balance between renewable water resources and demand; to improve the security of and equitable access to water services received by rural and urban users; and to improve the efficiency and productivity of water use by all sectors.

The study reported here reviewed the state of knowledge regarding the use and utility of regulatory instruments in the water sector internationally, regionally and in Rajasthan. Specific attention was given to the practical lessons learnt that are relevant to the implementation of the 2010 Rajasthan Water Policy and to the sector reform activities of the EU-supported State Partnership Programme. Important findings from the study include:

- Current focus is mainly on using economic instruments for regulating water use. The emphasis of the 2010 Rajasthan Water Policy is on charging for water so that users have incentives to reduce water use and, where relevant, to switch to water uses that derive higher social, economic and environmental benefits. However instead of focusing mainly on water tariffs, a much wider range of regulatory instruments could and should be considered. In addition, regulatory instruments should be matched to different groups of water users and uses.
- Metering of water or power for pumping is needed if tariffs are to impact on water use. The impact of tariffs on water use (and/or on power use for pumping water) is conditional upon there being a direct relationship between quantum of water (or power) used and cost to the user. Or put another way, metering of water (or power) usage by individual users is a pre-requisite for regulatory systems that aim to manage demand for water (or power) via economic instruments.
- Few examples exist of economic instruments being used successfully to manage demand for irrigation water. For historical, technical and administrative reasons, only a small proportion of irrigation schemes worldwide have volumetric measuring devices at the user level and, as a consequence, successful examples of demand management of irrigation water using economic instruments are few and far between.
- There are strong reasons for not using economic instruments to manage demand for irrigation water. At low prices, the elasticity of water use (or power use for pumping) is very low (e.g. when the cost of water is less than 5 per cent of income even a doubling of tariffs may not change behaviour). In addition, raising tariffs to find a degree of elasticity, that will change behaviour, may not be politically acceptable given that this could inflict undue hardship on relatively poor users. Hence, attempting to impose formal reforms such as water pricing and new "regulatory" institutional structures in essentially informal water economies (e.g. the

tens of thousands of private well owners in Rajasthan) is ill-advised not because they are not needed, but because they are likely to fail.

- Managing demand for water has been more successful in urban areas. Demand management through pricing is often effective in managing domestic supply but this approach is rarely successful in the agricultural sector. Empirical evidence shows that a better option is to control agricultural demand for water via supply management and establishment of quotas.
- Many water users in water scarce areas have plentiful supplies of water. Although they may be located in a water scarce region or zone, many water users do not experience scarcity themselves because their land holdings are located near a canal off-take (rather than at the tail end) or because they have a high yielding well. Hence, they are likely to be profligate in their water use regardless of the fact that they are living in a water scarce region.
- Political factors often influence access to water. It is not unusual for an irrigation scheme or a section of an irrigation scheme that is part of *warabandi* system to have a relatively high level of political support or patronage (and hence more water).
- Use of regulatory instruments can result in unintended consequences. Regulation often gives rise to externalities and perverse outcomes not least because widespread use of these instruments can have disproportionate impacts on environmental flows or the access to and use of water by poor and marginal water users.
- Paradoxically water-saving technologies can increase water use per unit of area. Many government programmes promote water conservation and saving technologies (WCTs) with the aim of encouraging water conservation and water savings. However, there is increasing evidence regionally and internationally that, somewhat paradoxically, WCTs can and often do prompt farmers to intensify their water use (i.e. increase net water use per unit area or per land holding).
- Up-scaling successful community water management pilots can be difficult. Similar to above, the lessons learnt from programmes that include encouraged self-regulation of water include the fact that community-based systems can work well at the small-scale particularly if users receive regular long-term support from a NGO. However, scaling up encouraged self-regulation in time and space is proving to be difficult and/or costly.
- Use of Independent Regularity Authorities (IRAs) by the water sector has yet to take off in India. To date, Maharashtra is the only state in India to establish a functioning water-sector IRA. External evaluations of this IRA have questioned the democratic legitimacy, accountability and transparency of the Maharashtra IRA's decision-making processes. However, as part of the Government of India's Twelfth Five Year Plan "*a model bill for state water regulatory system has been drafted. This draft is based on a thorough study of latest international thinking on regulation as also the experience of the Maharashtra Water Resources Regulatory Authority (MWRRA). The draft bill tries to resolve the conflicting demands of autonomy and accountability brought into sharp relief by the Maharashtra experience. It does so by proposing a regulatory system with inter-related but separate institutions that handle distinct governance functions*[1]"

The overriding conclusion of the study is that regulation and management of demand for water, particularly by agricultural users, is far from easy. Or put another there are no quick "regulatory" fixes that can be adopted in Rajasthan. This said, there is no denying the

[1] Quoted from: Shah,M. 2013. Water: Towards a paradigm shift in the Twelth Plan. EPW Vol XLVIII No.3

fundamental importance to Rajasthan's future prosperity of developing viable scaleable water regulatory systems. So what are the most promising ways forward for Rajasthan? The following are recommended as being worthy of consideration and piloting:

- Use a mix of regulatory instruments. A range and different mixes of regulatory instruments could and should be piloted and adapted that recognise the fundamental differences between domestic, agricultural, commercial and industrial users and between different public and private supply systems (e.g. private pumped-groundwater systems, public gravity-fed systems etc);
- Adaptation of regulatory approaches required. Pragmatic solutions are needed that are well matched to Rajasthan's political, cultural and historical context. Or put another way, replicating or mimicking successful regulatory systems from elsewhere is unlikely to be successful. The focus should be building on local knowledge and successes even if they are currently limited in their scale;
- Learn from interesting pilots in Gujarat. Specific consideration should be given to implementing a regulatory system that is based on a regime of flat power tariffs and intelligent rationing of power supplies that has been piloted in Gujarat. This could be used alongside other direct controls on water use such as the establishment of groundwater sanctuaries (either area or depth based). Interestingly the Twelfth Plan endorses and aims to build on experience from Gujarat concerning physical segregation of power feeders to provide 24×7 electricity to rural habitations and non-farm users, with separate feeders giving 3-phase predictable supply to agriculture, which is rationed in terms of total time, at a flat tariff. With the aim of providing requisite power to schools, hospitals and the non-farm economy, while allowing rationed supply of power to agriculture.
- Regulatory systems should differentiate between consumptive and non-consumptive water uses[2]. Specific consideration should also be given to regulatory systems that differentiate between consumptive and non-consumptive water uses. Similarly, it is important that regulatory systems recognise that opportunities for saving or freeing up water for other uses is somewhat limited given that all of Rajasthan's river basins have reached a "deficit" or "closed" status;
- Consumptive and non-consumptive water uses should be monitored. Similar to above consumptive and non-consumptive water uses should be quantified and mapped as part of a state-wide integrated water planning and management system. Such a system should be used to identify and monitor: (1) Major consumptive users and uses in time and space and (2) Opportunities for recycling non-consumptive uses (e.g. better recycling and use of wastewaters from urban areas);
- Monitoring systems should make use of modern technology. There is scope for better utilisation of modern technology to improve monitoring of water resource status and the sharing of information horizontally between stakeholders at the same institutional level and vertically between stakeholders at different institutional levels. For example, smart phones and open-access cloud-based information systems could be used to encourage the active involvement of users in monitoring and social auditing;
- Institutional support mechanisms may be needed to support self-regulation. Clearly, encouraged self-regulation could play a major role in the establishment and management of groundwater sanctuaries. However to be sustainable and equitable,

[2] A consumptive water use is that faction of water supplied to a specified area that is no longer available for re-use (e.g. evaporation from a crop). Non-consumptive water use is that fraction of water supplied to a specified area that can be reused (e.g. drainage water that recharges aquifers and is pumped and reused within the specified domain)

self-regulation may require long-term support from professional support agencies (e.g. NGO's and/or the private sector);

- Water-saving technologies do not always save water. Whilst water-saving technologies should be promoted as a means of improving water use productivity (i.e. higher useful output per unit volume of water), it should be recognised that adoption of these technologies may result in intensified water use (i.e. higher water use per unit area or per land holding*).*
- More debate is warranted on the utility of a Rajasthan IRA and its possible for form, functions and procedures. Given that, as of date, the 2012 Rajasthan Water Resources Regulatory Bill is being considered by the Standing Committee of the legislative assembly, an opportunity exists for debate: on whether or not IRAs are the best option for Rajasthan and, if yes, on the institutional norms that will determine the form, functions and procedures. Ideally this debate will be informed by relevant lessons learnt in Maharashtra and elsewhere. Consideration can also be given to the model bill for state water regulatory system has been drafted as part of the Twelfth Plan.

# 1 INTRODUCTION

## 1.1 The context

Water is very high on Rajasthan's political agenda. Demand for water in Rajasthan is outstripping supply and as a result new approaches to managing scarce water resources are being developed, piloted and promoted as part of the EC-supported State Partnership Programme. The State Cabinet approved the new State Water Policy (SWP) on 17 February 2010. The SWP and an associated State Water Policy Action Plan (SWPAP) signalled a shift in the role of the GoR from a controller to a facilitator of water services provision. Other important strands that run through the SWP and SWPAP include:

- Water User Groups and community-based management
- Regulation and demand management
- Water conservation and restoration of groundwater levels
- Revised and/or new water-related legislation
- Creation of a Water Regulatory Authority
- Improved cost-recovery through the introduction of differential water tariffs.

## 1.2 What are regulatory instruments?

As competition for water resources increases and the demand for good quality water outstrips supply, both regulating demand and providing incentives for managing demand become increasingly important. Regulation and standard setting are carried out in the public interest and, as such, are necessary functions of government (Svendsen and Wester, 2005), but other tasks may be fulfilled by commercial or hybrid public-private organizations (Millington, 2000). Regulation can also be initiated and used at the local-level, for example, as an important component of decentralised collective management of groundwater resources (Steenbergen, 2002).

> **Box 1. Types of regulatory instruments**
>
> *Economic instruments* e.g. prices, tariffs, subsidies, incentives, tradable permits, water markets, taxes
> *Direct controls* e.g. quotas, management rules, standards & norms, water rights, permits groundwater sanctuaries or conservation zones
> *Encouraged water conservation* e.g. promotion of water saving or water conservation technologies
> *Encouraged self-regulation* e.g. social policing, community management
> *Indirect management* e.g. energy pricing, energy quotas, groundwater markets, limiting credit

Institutions that have the responsibility for designing and operating regulatory systems have a wide range of regulatory instruments. These instruments fall into five main groups: direct economic instruments, direct controls, encouraged water conservation, encouraged self-regulation and indirect management (see Box 1). In practice, effective regulation of water use often requires a mix of instruments.

## 1.3 Why is regulation needed?

Regulatory instruments are needed to regulate water use, manage demand, minimise pollution and ensure that primary needs (e.g. domestic water supplies) are given priority. Regulatory instruments are also needed to protect the rights of vulnerable groups and to give explicit (rather than notional) attention to environmental flows[3]. Regulatory instruments can also be used to ensure that social, economic and cultural benefits gained from access to and use of water are maximised.

Regulatory instruments become increasingly important as competition for water resources and/ or risks of pollution increase. As demand for water has increased rapidly during the last 20-30 years, Rajasthan's river sub-basins and basins have progressed rapidly through three distinct phases. These are:

1. A *development phase:* In this phase, the amount of naturally occurring water was not a primary constraint except in the western districts. Access to surface and groundwater was controlled by availability of infrastructure. Even during prolonged meteorological droughts, absolute groundwater drought was extremely rare.
2. A *utilisation phase:* In this phase, demand had increased and the amount of naturally occurring water had started to be a constraint even in eastern districts. Significant construction had taken place and more attention was given to improving the operation, maintenance and management of existing infrastructure (e.g. via Water Users Associations (WUAs)).
3. A *reallocation phase:* Arguably the whole of Rajasthan is now in the reallocation phase. Demand has increased to the extent that naturally occurring water rather than infrastructure has become a dominant constraint. Basins or sub-basins are closed or near to closure[4] and there is limited scope for augmenting overall water availability by constructing new infrastructure.

**Table 1.1 Dominant Characteristics and Concerns during Different Phases of River Basin Development (after Molden et al, 2005)**

| Characteristics/ Concerns | Development | Utilisation | Reallocation |
|---|---|---|---|
| Approximate fraction of already flow allocated | Low (0 – 40%) | Medium (40 – 70%) | High (70 – 100%) |
| Dominant activity | Construction | Managing supply | Managing demand |
| Value of water | Low | Increasing | High |
| Groundwater | Development | Conjunctive use | Regulation |
| Pollution | Limited pollution. Pollutants are diluted | Increasing pollution. Increasing regulations | Emphasis on control and clean up |
| Poverty | Some improvements in access to safe water supply, irrigation and employment opportunities | Similar to "development phase" but with O&M and rehabilitation employment opportunities | High risk of deteriorating safe water supply, irrigation access and employment opportunities |
| Conflicts | Few | Within sector | Cross- sectoral |
| Typical institutional tasks | Planning & implementing construction | O&M. Rehabilitation | Inter-sectoral planning. Often large complex infrastructural projects |

As highlighted in Table 1.1, experience shows that the following institutional changes take place as basins approach closure:

[3] Environmental flows are the quality, quantity, and timing of water flows required to maintain the components, functions, processes, and resilience of aquatic ecosystems that provide goods and services to people (Nature Conservancy, 2006)

[4] Basin closure is the situation where more water is used than is environmentally desirable or, in some cases, than is renewably available.

- There is an expansion in the number of public and private sector actors involved in basin planning and management;
- Organisations associated with basin planning and management become more specialised and differentiated;
- There is a greater involvement of civil society in planning and management and;
- A broader range of disciplines plays a role in planning and management. A typical progression starts with engineers and hydrologists and expands to include economists, agronomists, management specialists, ecologists, public health specialists, water chemists and others.

In Rajasthan, the situation seems to be that water-related institutional change is lagging somewhat behind the realities on the ground. Or put another way, systems of water governance are still more applicable to the development phase (i.e. an emphasis of water development) rather than the reallocation phase (i.e. a focus of management and conflict resolution). Engineers continue to be the most influential discipline and engineering solutions have almost universal political and public acceptance as the best method of tackling water-related challenges.

## 1.4 What are the main challenges to the reform of regulatory systems?

Experience worldwide has shown that reforms, which involve modifications of existing, long established water use patterns, will be resisted, particularly if the reforms cut across existing rights, be they customary or legal. This is because social attitudes to water, and in particular the belief that groundwater is a private resource, do not change quickly irrespective of government views on ownership. It follows that water resource management is as much about managing people as it is about managing water. Consequently, water resource management systems need to be flexible and responsive to the changes in users' behaviour that they engender.

The view of Shah et al (2007) is that attempting to impose regulatory reform such as pricing and new forms of organisation in informal local economies (as found in Rajasthan) is ill-advised not because they are not needed, but because they will fail. Shah et al's advice is to focus attention on four areas:

1. Improving water infrastructure and services through investment and better management
4. Promoting institutional innovations at higher levels that reduce transaction costs and rationalise incentive structures
5. Focus demand-management on formal large-scale sectors such as urban and industrial water use
6. Use indirect instruments to achieve public policy goals in the informal sector.

In other words, rather than attempting to impose new institutional arrangements and water management practices (e.g. water pricing), the focus should be on promoting and facilitating innovation at local levels while, at the macro-level, the focus should be on putting effective infrastructure and institutions in place (Merrey and Cook, 2012). On the basis that over time, as the economy develops, the formal water sector will expand and the informal water sector will contract.

## 1.5 Aims of the study

The aim of the study reported here is to consolidate and review lessons learnt (positive and negative) from Rajasthan, elsewhere in India and internationally in terms of:

- Use of regulatory instruments to improve the sustainability, equitability and efficiency of water services delivery and to conserve water resources (in terms of quantity and quality);
- Institutional arrangements needed to set up, implement, operate and sustain regulatory systems in different contexts (including legislation);
- Potential effectiveness of different regulatory instruments (or mixes of instruments) with regard to different uses and users. With particular attention to potential inter-sectoral issues relating to regulatory frameworks and the effective management of inter-sectoral competition and conflicts;
- Benefits or otherwise of regulation based on volumetric measurements and the challenges associated with volumetric measurement in informal water economies;
- Potential negative impact of regulatory regimes on the poor, women and disadvantaged water users and small-scale productive uses of water;
- Potential for using regulatory instruments to maintain ecological flows and aquatic eco-systems;
- Wider challenges facing the sector e.g. climate change, food security, energy costs etc.;
- Up- scaling relatively small-scale success stories.

# 2 NATIONAL AND RAJASTHAN POLICY CONTEXT

## 2.1 National Water Policy

The emphasis of the 2002 India Water Policy (GoI, 2002) was mainly on augmentation and management of water supply. However, regulation was mentioned in the following contexts:

- *"Exploitation of ground water resources should be so regulated as not to exceed the recharging possibilities, as also to ensure social equity"*
- *"Efficiency of utilisation in all the diverse uses of water should be optimised and an awareness of water as a scarce resource should be fostered. Conservation consciousness should be promoted through education, regulation, incentives and disincentives."*

A new national water policy has been drafted and circulated for comment (GoI, 2012). The current draft is conspicuous by the fact that it still seems to view India's water problems as being linked primarily to lack of water availability and/ or supply rather than rapidly increasing demand. This said the current draft water policy includes a section on "Demand Management and Water Use Efficiency". It also gives relatively more attention to regulation than the 2002 India Water Policy.

- *"There is a need for comprehensive legislation for optimum development of inter-State rivers and river valleys to facilitate inter-State coordination ensuring scientific planning of land and water resources taking basin/sub-basin as unit with unified perspectives of water in all its forms (including precipitation, soil moisture, ground and surface water) and ensuring holistic and balanced development of both the catchments and the command areas. Such legislation needs, inter- alia, to deal with and enable establishment of basin authorities with appropriate powers to plan, manage and regulate utilisation of water resource in the basins."*
- *"A portion of river flows should be kept aside to meet ecological needs ensuring that the low and high flow releases are proportional to the natural flow regime, including base flow contribution in the low flow season through regulated ground water use."*
- *"A system to evolve benchmarks for water uses for different purposes, i.e., water footprints, and water auditing should be developed to promote and incentivize efficient use of water. The "project" and the "basin" water use efficiencies need to be improved through continuous water balance and water accounting studies. An institutional arrangement for promotion, regulation and controlling efficient use of water will be established for this purpose at the national level."*
- *"A Water Regulatory Authority should be established in each State. The Authority, inter-alia, will fix and regulate the water tariff system and charges, in general, according to the principles stated in this Policy in an autonomous manner. The Authority may also have functions other than tariff systems, such as regulating allocations, monitoring operations, reviewing performance and suggesting policy changes, etc. Water Regulatory Authority in a State may also assist in resolving intra-State water-related disputes."*
- *"The "Service Provider" role of the state has to be gradually shifted to that of a regulator of services and facilitator for strengthening the institutions responsible for planning, implementation and management of water resources."*

## 2.2 Water Policy of Rajasthan

In contrast to the National Water Policy, Rajasthan's State Water Policy (GoR, 2010) puts considerable emphasis on challenges related to increasing water scarcity and the fundamental need for regulation of demand. This is both a reflection of the severity of water challenges in Rajasthan and the willingness of the GoR to manage the supply of and demand for water. The following are extracts from Rajasthan's State Water policy:

- *"The availability of water in the State is not commensurate with the requirement of water. The deficit between demand and supply is 8 BCM at present and likely to increase to 9 BCM by 2015. Thus, the availability of water in Rajasthan is about 780 cubic meter per person per year as against the internationally accepted standards of 1000 cubic meter per person per year and is likely to reduce to 450 cubic meter per person per year by 2045."*
- *"Exploitation of groundwater for agriculture and purposes other than drinking will be so managed by public participation so as not to exceed the average long-term recharge potential."*
- *"The current ethos of uncontrolled groundwater extraction as an 'individual right', will be discouraged. It will be replaced by an ethos of community responsibility for the long-term sustainability of the aquifer as a community resource."*
- *"A programme of water metering for water management purposes will apply to all significant water users irrespective of source and water ownership."*
- *"All water rates will be set so as to convey the scarcity value of water and to generally motivate economy in water usage. While deciding the tariff this would be kept in view that those who cannot afford to pay will not be deprived off minimum quantity of potable water."*
- *"For all water supplies a three or four-stepped water tariff will be charged, with the highest rate for excessive use of water. This stepped water tariff will be set to ensure magnitude difference in water rates between the lowest and highest rates. For the first stepped rate of relatively cheap water, the set rate will be common to all water users."*
- *"Differing stepped water rates may be charged for agricultural, industrial, commercial, and municipal purposes. In all cases, the highest rate will be a strong disincentive for profligate water usage."*
- *"A legal framework will be developed for the regulation and management of groundwater extraction in general and in the 'Critical and Overexploited' zones in particular. Such legislation will also address the need for compensatory water conservation and recharge measures to be taken by the bulk water consumers."*
- *"Water Regulatory Authority would be set up."*

# 3 REGULATORY INSTRUMENTS

## 3.1 Economic Instruments

Water governance can be defined as processes through which decisions are made on the development, allocation, and the conditions of use of water resources at all levels of society. It involves the interactions between political, social, economic, legal, and administrative institutions - statutory as well as customary or informal- that determine how decisions are taken and how authority is exercised (Graham et al, 2003; Rogers and Hall, 2003; Cleaver and Franks, 2005; Merrey et al 2007; Ratner et al, 2010).

Recent years' efforts to reform national water policies and the associated legal and administrative frameworks in a number of countries (Aagaard and Ravnborg, 2006) can be seen as efforts to strengthen water governance, that is, to formulate policy objectives and ensure that legal and administrative frameworks at the various levels contribute to an achievement of these objectives. Yet, as pointed out in the 3rd World Water Development Report, many components of ongoing water reform are part of broader governance reform agendas, such as those related to decentralization and participation (WWAP, 2009: 246). Thus, at each level, ranging from the family, over the community and district, to the national and international level, water governance is shaped by, and helps to shape the way in which decisions are taken and authority is exercised in fields that extend well beyond water.

**Table 3.1 Impact of Pricing on Water Demand**

| Country | Price mechanism | Impacts on water demand |
|---|---|---|
| Israel | Block rate tariff | 7 % decline in average water use and 1 % reduction in output |
| Israel | Tiered system of pricing | Regulates water demand at margin |
| India | Price induced water scarcity | Farmers are responsive but water allocation is not efficient |
| Spain | Arbitrary Pricing | Differential impacts due to regional, structural and institutional conditions. |
| Sri Lanka | Arbitrary Pricing | Not effective |
| Turkey | O&M cost recovery pricing | No improvement |
| Mexico | O&M cost recovery with tradable bulk water rights to WUAs | No improvement at the farmer level. But over all improvement in water use efficiency due to internal trading. |
| China | Volumetric pricing at the WUA level | No incentive at the farmer level as the price at the farm level is based on area. |
| France | Full financial cost recovery | Managers only discourage water use beyond subscribed amount. |
| Peru | Volumetric Pricing | Not used to reduce water demand |
| USA | Volumetric pricing | Quotas were more effective in times of scarcity |

**Source:** Compiled from Molle (nd.); Dudu and Chumi (2008) and Johansson (2005).

Pricing of water, as a demand management variable, is expected to achieve the double benefits of reducing demand and improving financial sustainability of supply systems. However, studies across the world have observed limited impact of pricing on water demand (Table 2). This is despite the fact that most of the studies are clear in saying that pricing has the potential to achieve efficient allocation of water if certain conditions are met. These conditions include: (a) proper valuation of water resources (i.e., use value+ scarcity value+ existence value), (b) institutional mechanisms like water user associations and regulatory authorities to support implementations of pricing policies, (c) technologies to enhance water productivity and (d) water rights that legalise access to water resources and, in some cases, make water tradable (Reddy, 2009).

However, in most cases optimum or marginal pricing of water is neither determined nor implemented. In the absence of optimal or threshold level pricing, the impact of economic instruments on demand is limited. The threshold pricing that would influence demand is often high making it politically sensitive to implement. Evidence in India shows that water pricing barely covers O&M expenditure even in the reform states where cost recovery is being attempted. As such, water pricing is having a negligible influence on water demand (Reddy, 2003, 2006).

The use of economic instruments in irrigation management has been widely promoted over the last two decades (Molle 2011). Pricing policies were expected to improve operation and maintenance, conserve resources, and promote reallocation of irrigation water towards higher-value crops and economic activities. The emerging picture, however, is that of a gap between stated objectives and expected benefits on the one hand, and the actual and foreseeable impacts of these policies, on the other. While price mechanisms have shown their usefulness in the energy and water supply sectors (albeit with variations according to context), these results cannot be easily extrapolated to the public irrigation sector, which is largely composed of large-scale gravity irrigation schemes. It is indeed crucial to distinguish between gravity irrigation and pumping schemes, for which the costs of abstracting water are higher and somehow proportional to the volume of water used; and among pumping schemes between state pumping stations and pumping by individuals; and among the latter between shallow (often dug) wells and deep-wells, for which pumping costs may be very high and water tables may be dropping (Molle, 2011).

Shah *et al*. (2008) have documented the impacts of increasing pumping costs in the Indo-Gangetic basin and identified a series of coping strategies that go well beyond the conventional “encouragement” to curb alleged “wastage” and generally dent farmers’ income (e.g. deficit irrigation, reducing cropped area or intensity, adoption of water-saving crops or technologies, abandonment of agriculture). The situation is critical in parts of India where a nearly 7- fold increase in the nominal price of diesel was observed during 1990-2006, a period during which the nominal farm gate rice price of produce rose by just over 60 per cent. In other places like Pakistan or Bangladesh, subsidies have dampened this impact. The incentives of tariff regimes are relatively lower in the case of pumping from surface water bodies or shallow aquifers because the cost of pumping is generally lower per unit volume of water. Typically this is observed in lowland valleys and deltas of Asia, where aquifers are replenished each monsoon.

When discussing tariffs, it is important to recognise that there different types and structures. These include:

**Non-volumetric tariffs**. These are tariffs, which do not require actual usage to be assessed. Such structures are appropriate where it is not practical or not cost effective to assess usage levels (e.g. because of the costs of installing meters and collecting usage information relative to the value of that information). Common examples of non-volumetric tariffs are flat fees per resident, or per household (e.g. for community latrines), or per sewerage connection, or fees based on the diameter of the household water connection, or irrigation fees per area of irrigated land, or per volume of crop grown.

Molle and Turral (2004) argue that the impact of prices on water use is conditional upon having a direct relation between the volume used and the cost to the user. Or put another way, metering of water used by individual users is a pre-requisite for a regulatory system that aims to manage demand via economic instruments. But for historical, technical and administrative reasons a very small proportion of irrigation schemes in the world have volumetric measuring devices at the individual level. Not least because such devices or structures are easy to tamper with and the transaction costs of enforcing, monitoring and collecting volumetric information at the user level are well beyond the capacity of irrigation agencies and a significant challenge for agencies responsible for delivering water services in urban areas.

**Volumetric tariffs**. Here, actual volume is measured. Common examples include flat rate, rising block and seasonal tariffs:

i. **'Flat rate' or 'linear'.** This is the simplest form of volumetric tariff. As the name suggests, a single rate is charged per unit of usage (e.g. per cubic meter of water used). This structure has the advantages of being easily understandable, generally perceived to be fair, and is simple to administer. However, a flat rate means that households using water for basic needs pay at the same rate as heavier users, and also that poor households have incentives to restrict their usage below levels considered to be necessary to meet basic needs (though both effects may be offset through subsidies as well as through different tariff structures).
ii. **Rising block tariffs.** This is where there are increasing tariffs per unit of water for higher levels of consumption. Rising block structures can be used to signal the true cost of water to customers using large volumes of water, while allowing subsidised prices for "essential use". Thus the charge applied to the top block of consumption could reflect the marginal cost of water. The lower blocks provide an element of subsidy and hence protection for low- income households. A common difficulty with rising block structures arises in determining the appropriate cut-offs for the blocks. Unless the cut-offs are related to numbers in the household (which is administratively expensive) large households will be penalised. In contrast, if the cut-off is set at a generous level, it risks leaving relatively few customers facing a true marginal cost tariff, and hence will have little advantage in terms of demand management.
iii. **Seasonal tariffs** are tariffs, which change depending on the time of year. They are appropriate where the demand/supply balance differs significantly by season. Examples include areas where there are marked differences in:
   - *Water supply between seasons:* For instance, summers may be characterised by lower availability of water, or there may be alternative water sources (which may be not tariffed) which are seasonal;
   - *Water demand between seasons*: For example, areas may attract large numbers of seasonal residents, or demand on public water supplies may rise in the dry season due to increased reliance of livestock on these systems.

## 3.2 Direct controls

Whilst the overwhelming focus of the SWP and SWPAP is on economic instruments, direct controls (e.g. quotas, management rules, norms, rights) are both pragmatic and widely applied to manage water supply rather and demand. Molle and Turral (2004) argue that demand management through pricing is often effective in managing domestic supply but this is not the case in the agricultural sector. In part, because the elasticity of water use is very low at low prices; when the cost of water is less than 5 per cent of income even a doubling may not change behaviour. In part, also because raising tariffs to find a degree of elasticity is almost certainly politically impossible not least because this is likely to hit poor farmers much harder than farmers who have larger land holdings, are more professional and more commercially savvy.

Molle and Turral (2004) argue also that direct controls adapted to the local context appear to be the easiest and most efficient means of reducing water use. Direct controls have two overwhelming advantages over economic instruments. First they ensure a degree of transparency and equity in the face of scarcity. Second they are directly effective in bringing use in line with available resources. This adjustment by users is made easier if supply is gradually, rather than abruptly, decreased and if the reduced supply is both predictable and dependable.

But how can direct controls be implemented in Rajasthan given that Rajasthan's water economy is predominantly informal and small-scale? (i.e. most users rely wholly or partially on accessing their own unlicensed bore wells). Attempts to meter and regulate use of water from hundreds of thousands of privately-owned bore wells would almost certainly fail. Imposing direct controls on access to water on government irrigation schemes would also be far from an easy task, primarily because despite Rajasthan being located in a water-scarce area, many users face no scarcity at all. This may be because their holdings are located near canal off-takes or, even if their holding is towards the tail-end of a system, they may also be able to access water from their own bore wells. At the larger system scale, some water users or systems may enjoy a high level of political support and, as such, they are likely to be allocated and receive more water than other users.

Given also that the empirical evidence shows water use is invariably curtailed through supply management and establishment of quotas, rather than by price mechanisms (Molle, 2011), it seems that, despite the challenges, direct controls could and should be part of Rajasthan's mix of regulatory instruments. But to be politically and socially acceptable, they have to be used alongside encouraged self-management (e.g. groundwater sanctuaries or conservation zones) and compensation schemes.  As will be discussed below, it may be possible to incorporate direct controls into a system of intelligent rationing of power for pumping groundwater.

## 3.3 Encouraged water conservation

A powerful narrative associating low efficiency in irrigation systems with the low level of water charges has widely promoted the idea that raising charges would achieve substantial conservation of resources. This narrative draws on evidence from the water supply and energy sectors but can be highly misleading when extended to the case of large-scale gravity irrigation schemes (Molle, 2012).

- First, even if average scheme efficiencies suggest otherwise, water is not always wasted: (a) it may be temporarily abundant in a given location, with no impact on other uses because these are either satisfied or too distant to allow reallocation; (b) losses occur locally but return to the water cycle and are reused downstream; and (c) in the extreme case of an over allocated (closed) basin, only losses to a sink can be recovered and there may be little water to save.
- Second, even when some water is wasted, the causes often lie largely beyond the control of the end-users (the farmers): (a) farmers can do little to prevent system-level losses that may constitute up to half of the total; and (b) system wastage and shortages are often largely due to unpredictable supply to the scheme, improper internal management and/or poor design rather than farmer behaviour. Unlike in urban piped systems, where users may normally access water at will, farmers often only use water when (and if) it is delivered to them. Possible savings at the plot level are largely irrelevant and losses or uneven distribution are primarily a management issue. When

system management improves, “wastage” declines, thus again lowering the potential gains from introducing water pricing at the user level.

- Third, even when water is wasted at farm level, raising prices generally has no impact on irrigation efficiency. This is mainly because few irrigation systems use volumetric management, and even those that have often do not charge users volumetrically. Moreover, in the rare cases where water is charged according to volume, prices are almost invariably too low to induce a change in behaviour. This is all the more true because modern schemes with volumetric management are often pressurized and associated with high value crops, which means that: (a) water costs are negligible in the crop budget, (b) efficiency is already high, and (c) the costs of achieving higher efficiency would normally offset any gains from a lower water bill.

Water conservation and saving technologies (WCTs) are promoted widely as an indirect means of regulating demand by improving water use efficiency and freeing up water for others uses. However, there is increasing evidence regionally and internationally that somewhat paradoxically WCTs can prompt farmers to intensify their water use (i.e. increase net water use per unit area or per land holding) (e.g. Ahmad *et al*, 2007; Molle and Berkoff, 2007; Ward and Puldido- Valazques, 2008). This happens when the improved productivity and profitability resulting from adoption of WCTs, encourages medium and large farmers in particular to increase the area cropped and increase the number of crops per year. Increased profitability can also prompt farmers to overcome physical constraints on their access to water by investing in new bore wells and water storage or recharge structures.

Recognition is also growing amongst many water professionals that claimed water savings of many WCTs are overstated (KAWAD, 2005; Crase and O’Keefe, 2009; Hanak *et al*, 2009; Perry, 2007). The cause of this problem lies in confusion over issues of scale and what constitutes real water savings at the system or basin scales. The simple fact is that some of the water that proponents of WCTs claim to have been ‘saved’ would have percolated into the groundwater from where it can be accessed and reused. Similarly, often downstream farmers and other users use some of the run-off that has possibly been “saved”. There is also increasing recognition that amongst many water professionals that opportunities for saving water or freeing up water for other uses may be very limited in river basins that are fast approaching a “deficit” or “closure” status (i.e. a situation in which water resources are fully allocated at least some of the time).

Notwithstanding the above, it is clear that improvements in water productivity are highly desirable in Rajasthan. Many WCTs have the potential to improve water productivity if they are well managed and well matched to a given context. The fundamental problem is that, if a WCT delivers higher profits, farmers will invest in this WCT and, in many cases increase their overall water use per unit area of per land holding. Hence, it may then be necessary to regulate the use of WCTs either directly or indirectly. Trade-offs also exists between increasing water productivity and ensuring that poor farmers have equitable access to water for productive purposes. Experience has shown WCTs are more likely to deliver improved water productivity if and when they are used by farmers who have the knowledge and economic ability to invest in all aspects their production systems (e.g. in good quality seeds, fertilisers and pest control; timely land preparation and planting; good post-harvest technology and marketing). Hence, better-off farmers with larger land-holdings are better placed to improved water productivity than poorer often-indebted farmers.

**Table 3.2 Community Based Groundwater Management Initiatives in India**

| Locations | Organisation(s) | Scale | Resource Person(s) | Method | Tools Used | Parameters Measured |
|---|---|---|---|---|---|---|
| Andhra Pradesh | APFAMGS | Villages, spread over districts | Farmers | Farmers record hydrologic variables | Simple budgeting tools in Excel | Water levels, rainfall, well yield, crops, water use for crops |
| Andhra Pradesh | WASSAN | Village | Farmers | Social regulation; Farmers record hydrologic variables | Hydrologic information for formulating equitable distribution | Well Water level, rainfall, |
| Rajasthan | Barefoot College | Village | Farmers | Farmers map all water bodies and record hydrologic variables | A simple tool called 'Jal Chitra' | Well water levels, crops, water use for crops |
| Rajasthan, Madhya Pradesh, Andhra Pradesh | FES | Watershed | Organisation and University Research Unit | Organization carrying out monitoring program | Simple water modelling tools | Well Water levels, rainfall, crop water usage |
| Madhya Pradesh and Maharashtra | ACWADAM in partnership with SPS and GGP (Pani Panchayats) | Watershed / Aquifer | Hydro-geologists, Watershed Teams and Farmers | NGO and scientists carrying out monitoring program | Hydro-geologic mapping of watershed | Aquifer mapping, flow dynamics, modeling |
| Kutch, Gujarat | ACT | Village/ Aquifer | Barefoot Geologists (called para workers) | A program for training local youth as geologists | Geologic mapping of saline and freshwater lenses | Aquifer mapping and delineating water quality |
| Bihar and Saurashtra, Gujarat | INREM | Village | Well drillers and farmers | Documenting local knowledge of people on hydrogeology | Aquifer mapping tool and fence diagrams | Lithology and mapping major geological features |
| Maharashtra | Hivre Bazar GP | Village/ Watershed | Sarpanch | Rainfall based water budgeting and GP rules | Measurement & participatory tools | Rainfall, water levels, crops |

## 3.4 Encouraged self-regulation

Participatory groundwater management is evolving gradually in India. It essentially involves communities observing groundwater variables and attempting local-level, groundwater planning and management. This effort is aimed at augmentation, conservation and improving patterns of groundwater use (see Table 3). These initiatives are *diverse* in terms of their scale (village, aquifer, watershed) and approach (farmers collecting data, well drillers providing information, hydro-geologists carrying out surveys, local youth being trained to map the geology). However, they have the common purpose of developing initiatives that are knowledge-based and aimed at improved management of groundwater resources. The rationale being improved management will result from decisions taken at the scale of a village or micro watershed that are based on some degree of scientific understanding of groundwater resources. Of course, it goes without saying that the involvement of Government institutions in such initiatives would greatly help in the scaling up of such efforts. They would also help in terms of the development of legal instruments that complement such efforts rather. Good legal instrument should provide the protective cover to such initiatives rather than put stress on 'symbolic' actions such as licensing, policing and punishment, all of which fall under the purview of "command and control" type interventions. In this regard, the Twelfth Plan advocates the adoption of a participatory approach to sustainable management of groundwater based on aquifer mapping that takes into account the common pool resource nature of groundwater. It is envisaged also that participatory aquifer management will overcome the problem of groundwater extraction for irrigation leading to failure of sources of domestic water supply by y producing and implementing a "comprehensive plan for participatory groundwater management based on aquifer understanding, bearing in mind principles of equitable distribution of groundwater across all stakeholders" (Shah, 2013)

The *pani panchayats* (or water councils) in Maharastra were one of the first institutions to promote and support social regulation initiatives aimed at improving access to water, water use efficiency and equity. Social regulations are developed and implemented by *pani panchayats* that: restrict digging of bore wells; specify cropping pattern; and, manage water distribution and equitable access to water to all households, including landless. This was adopted in a number of villages with mixed results (Deshpande and Reddy, 1990). A different type of encouraged self-regulation can be found in Rajasthan. Villagers decided to stop sinking of bore wells to preserve and judiciously use the water resources at their disposal. As a result no bore wells are found within the 4 km radius of the village (IRM&ED, 2008). In Kerala, two community managed groundwater projects were implemented for proper utilization of water for irrigation. As per the instructions two persons can irrigate their land at a time. Farmers bear electrical and O&M charges and succeed to achieve financial and source sustainability. Check Dam Movement was started in Gujarat where farmers formed village level local institutions (Gandhi and Sharma, 2009). Under this system villagers undertake planning, finance and construction of a system of check dams in and around the village to collect and store rainwater to recharge the groundwater aquifers and thereby recharge the dug wells. Expected benefits are a rising water table and improved agricultural income. However, there was no collective action on reducing over-extraction. Communities were self- interested and every farmer in the community was free to extract whatever they want rather than focusing on collective targets for crop diversification or water use reduction.

**Table 3.3 Examples of Local Groundwater Regulation**

| Case | Country | Size (hectares) | Type of Management | Measures |
|---|---|---|---|---|
| Mastung | Pakistan | 2-3,000 | Informal, committee | Spacing rules, zoning |
| Panjgur | Pakistan | 2-3,000 | Informal norms | Ban on dugwells |
| Alwar | India | Scattered | Community organisation | Recharge, regulation of wells |
| Saurastra | India | Scattered | Informal norms, leadership | Recharge, regulation of wells |
| Salheia | Egypt | 1,000 | Water user association | Common network, ban |

| | | | | |
|---|---|---|---|---|
| Costa de Hermosillo | Mexico | - | Groundwater association | Water saving measures |
| Queretaro | Mexico | - | Groundwater association | Water saving measures |

**Source:** Steenburgen. 2002.

Steenburgen (2002) reviews and summarises another seven groundwater regulation initiatives. Whilst this review provides interesting insights and lessons relating to collective action in relation to regulating demand, the emphasis of most of these initiatives was on augmentation of water supply. For example, one of the mantras of the Saurashtra Recharge Movement was "The rain on your roof, stays in your home; the rain in your field, stays on your field; the rain on your village stays in your village". As a rallying cry, this is, of course, brilliant. However as a thumb rule for managing scarce water resources in closed basins, these leave a lot to be desired not least because it puts zero value on the importance of run off to downstream users. Also this mantra, fails to recognise the fundamental importance of managing both the supply and the demand in water scarce areas if groundwater overdraft is to be avoided.

Of late quite a few initiatives of social regulation are being tried in a number of states. Some of them are knowledge based and some combine awareness building with social regulation (GoI, 2011). These include: (i) the pioneering and large-scale APFAMGS programme in Andhra Pradesh aimed at involving farmers in hydrological data generation, analysis and decision making, particularly around crop-water budgeting; (ii) social regulation and water management implemented by the Centre for World Solidarity (CWS) with its partner NGOs in AP; (iii) social regulation in groundwater sharing under the AP Drought Adaptation Initiative (APDAI) involving WASSAN, in parts of AP; (iv) experiences from Barefoot College, Tilonia, with a water budgeting tool known as Jal Chitra; (v) efforts by Foundation for Ecological Security (FES) at taking a micro-watershed unit for water balance and planning groundwater use along with communities at their sites in Rajasthan, MP and AP; (vi) experiences of ACWADAM with SPS in Bagli, MP and with the *pani panchayats* in Maharashtra on knowledge-based, typology-driven aquifer-management strategies; (vii) training programs and drinking water initiatives by ACT in Kutch on the back of training local youth as para-professionals for improved groundwater management; (viii) research on documenting local groundwater knowledge in Saurashtra and Bihar by INREM Foundation and (ix) the Maharashtra's Hivre Bazar model of watershed development and social regulation to manage water resources.

Community-based management programmes should be designed with a shared focus on improving agricultural productivity, income and water conservation. Water use reductions should not be explicitly sought but realized by aligning efficient irrigation interventions with farmer incentives for higher profits. Planning Commission (GoI, 2007) also agrees with the fact that community management `should not work well unless it serves some basic needs of farmers'. According to the World Bank (2010), stakeholders' participation in the management process is necessary because it disseminates understanding of issues that can be the impetus for up- scaling of good practices in the sustainable use of groundwater. It also improves the self-regulatory capacity, counteracts corruption and facilitates the coordination of decisions relating to groundwater, land use and waste management. According to Burke, *et al* (1999), socio-economic, political and institutional factors are the main determinates, which incentivise these stakeholders in sustainable groundwater management.

## 3.5 Indirect management

There are few tools available for regulating groundwater at scale and even these are inadequate (Shah *et al*, 2007). The alternatives fall into two broad categories: (i) *direct* *management* through a system of metered tariff and/or quotas and (ii) *indirect management* e.g. through the operations of the power market[5].

Despite widespread farmer opposition, the power industry and those involved in the groundwater sector believe that South Asia needs metered power supplies along with a workable tariff regime. Not least because current zero or flat power tariffs reduce the marginal cost of groundwater extraction to nearly zero. This in turn produces strong perverse incentives for farmers to indulge in profligate and wasteful use of power and water (Moench, 1995; Shah et al, 2007). For a metered tariff regime to be effective, the following appear to be essential:

- The metering and collection agent must have the requisite authority to deal with deviant behaviour amongst users;
- The agent should be subject to a tight control system so that he can neither behave arbitrarily with customers nor form an unholy collusion with them;
- The agent must have proper incentives to enforce a metered tariff regime.

Under agrarian conditions that in many ways are comparable with South Asia, these three conditions seem to be met in North China where a metered tariff regime works (Shah *et al*, 2007). The big question is therefore why shouldn't such a regime work in Rajasthan and the rest of South Asia. The view of Shah *et al* (2007) is that North China offers a good model but there are two initial problems:

- Agricultural productivity is much higher in China than in most of South Asia and, even with power charged at full cost, pumping constitutes a relatively small proportion of the gross value of output. Pumping costs of the order of \$46-197 $ha^{-1}$ (2007 costs) would make irrigation unviable in many areas of South Asia.
- When compared to China, governance systems at the local level are relatively weak in South Asia. More specifically, in China, farmers fear the village electrician whose informal powers border on the absolute.

Given the above, Shah *et al* (2007) suggest transforming the current flat power tariff regime to a more rational tariff regime will be easier and more beneficial than trying to overcome farmer resistance to metering. This would include raising flat tariffs in steps and restricting annual supply of farm power to 1000-1200 h/year compared to 3000-3500 h/year at present. Shah *et al* (2007) also suggest that the strongest argument for rationing of power is that, for more than a decade, most SEBs has already rationed power to farmers in some way or other. However, they also suggest that the current approach to rationing could be improved substantially by:

- Matching power supply schedules with agronomic demand;
- Demand- based scheduling of power supply according to demands agreed with WUAs;
- Matching power supply schedules to the pattern of canal water supply. Thereby ensuring the groundwater and canal irrigators received similar levels of water services delivery;
- Zonal rosters that provide power to different zones of a state on a rotational basis.

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[5] For example, Shah (2013) reported that the Government of Gujarat invested Rs 5,600 crore during 2003-06 to separate 8,00,000 tubewells from other rural connections and imposed an eight hour/day power ration but of high quality and full voltage. This was combined with a massive watershed development programme for groundwater recharge. The net result has been: (a) halving of the power subsidy; (b) stabilised groundwater draft; and (c) improved power supply in the rural economy. Combined with other measures such as High Voltage Distribution System (HVDS), especially designed transformers and energy-efficient pumpsets, this could be a better way of delivering power subsidies that cuts energy losses and stabilises the water table at the same time. Major investments are proposed in this direction in the Twelfth Plan.

If the above were achieved, the net result would be intelligent rationing of power. Farmer resistance to increasing flat rate tariffs and intelligent rationing can be reduced if such reforms are accompanied by:

- Enhancing the practicability and dependability of power supply;
- Improving supply quality;
- Better matching of power supplies with peak periods of moisture stress;
- Better maintenance of power supply infrastructure.

Other authors have also proposed that regulation of groundwater is best achieved via electricity pricing. For instance, it is argued in the context of Western India that electricity pricing enhances groundwater use efficiency (Kumar, 2005). This study estimates the levels of pricing at which demand for electricity and groundwater becomes elastic and shows that pricing is socio-economically viable. But the main difficulties lying with the price mechanism is that of implementation. There is lack of required administrative resources for metering and monitoring groundwater use and collecting user fees. During the 1970s', the Government of India faced major difficulties metering about 2 million wells and thus implemented a flat tariff on electricity used by agriculture. At present the number of wells is over 20 million aggravating administrative difficulties and transaction costs. Besides, pricing is a politically sensitive issue, especially when populism has become the norm (Kemper, 2007).

Whilst agreeing that policies governing the pricing of power and electricity supply offer a powerful means of indirectly managing groundwater and energy use, some authors have suggested that it is far from clear that indirect regulation via changes in power pricing would result in more sustainable levels of groundwater use (e.g. COMMAN, 2005). Returns from groundwater irrigation often outweigh the disincentives resulting from changes in power pricing and such changes, in the absence of power quotas, therefore have a limited impact on overall volume extracted (Moench, 1995; Kumar and Singh, 2001). In addition, it is difficult to tailor pricing policies to meet groundwater extraction needs in specific areas (COMMAN, 2005). Groundwater levels have been rising in canal command areas. Yet overdraft occurs in nearby areas. Pricing policies may therefore help reduce groundwater overdraft in certain areas only to contribute to water logging in others.

Groundwater markets are another indirect management option. Private groundwater markets have a long history in rural India (Pant, 2005, Saleth, 1994). Even though selling of water was traced out during 1920s', it was in the 1960's when systematic information started flowing (Saleth, 2005). Groundwater markets are widespread in Gujarat, Tamil Nadu, Andhra Pradesh, Uttar Pradesh and West Bengal (IRM&ED, 2008). However, there is no clear- cut statistics about the total area under private groundwater markets. Based on his studies from Gujarat and Uttar Pradesh, Shah (1993) projected that the area irrigated under groundwater markets was about 50 per cent of the total gross irrigated area under private lift irrigation. Whereas Shankar (1992) mentions that the actual area varies between 80 per cent in Gujarat to 60 per cent in Uttar Pradesh. A Tamil Nadu study shows that it is not more than 30 per cent (Janakarajan, 1993).

Groundwater markets are formed on the basis of mutual understanding between adjacent farmers on sharing of water (Mukherji, 2007). They serve two purposes: promoting efficient use and providing water to poor farmers who are either unable to afford wells or find it uneconomical to do so (Shah, 1989, 1993; IRM&ED, 2008)[6]. Markets also increase cropping

[6] Markets and regulations can be sought as instruments for water allocation (Frederick 1993; Howe *et al*, 1986). Howe and co-authors suggest six criteria for comparing alternative institutional arrangements to allocate water: (a) flexibility in allocating supplies in response to both short-term and long-term changes; (b) security of tenure to encourage investment in and maintenance of water- use system while allowing for users to respond voluntarily to incentives to reallocate supplies; (c) whether or not the user is confronted with the real opportunity costs of the resource; (d) predictability of the outcome of the transfer; (e) equity impacts; and (f)

intensity and demand for agricultural labour, which ultimately benefits the landless and wage labour (Fujita and Hussain, 1995).

Finally, groundwater extraction can be managed indirectly via credit controls. In the case of credit regulation field research has shown that it was not very effective due to the availability of other credit avenues (mainly informal sources) at the village level (Kumar, 2007)[7]. This is despite the fact that cost of credit is high for the informal sources. Credit rationing policy of the bank is also trying to curb new power connection to bore-wells and put restrictions on electric power supply. Besides, enforcement is also lax due to the pressure on banks to achieve targets.

whether or not the public values are adequately reflected in the process. Frederick (1993) adds low-transaction costs of moving water from one use to another to this list. But, both markets and regulatory approaches are likely to fall short of satisfying all these criteria for efficient and effective water allocation.

[7] Demand for water is extremely high in Rajasthan where water resources are very scarce, and groundwater is the major source for all purposes. Pumping regulation in areas facing over-development problems through groundwater legislation, control of institutional financing for well development and the restriction of power connections for pumps have been by and large ineffective in these regions (Kumar, 1995; Kumar, 1999/2000). Further, long distances involved in the conveyance of water between regions of abundance and shortage, reduces the ability of the government to invest in public water systems for the supply of water in bulk as it has serious financial and environmental imperatives. Inadequate finance too restricts public investment in large- scale inter-basin transfer projects, as discussed earlier (Chaturvedi, 1999). The absence of well defined property right regimes is a major source of uncertainty about the negative environmental impacts of resource use, leading to inefficient and unsustainable use. This has been apparent in the case of both groundwater and canal water supplied for irrigation (Pearce and Warford, 1993; Kay, *et al*, 1997; Marothia 2005c, 2009a &2010). In the Indian context, many researchers in the recent past have suggested establishment of property rights as a means of building institutional capability to ensure equity in the allocation of and efficiency in the use of water across sectors (Singh, 1995; Chaudhary, 1997; Kumar, 1997; Saleth, 1996; Kumar, *et al*, 1999; Kumar, 1999/2000; Marothia, 1992a &b, 1993, 1995, 2005c, 2006, 2009a &b, 2010,). But, again, if the rights are allocated only on water use, this can result in the expending of water without good use for it (Frederick, 1993). Therefore, water rights have to be tradable (IRMA/UNICEF, 2001; Kumar and Singh, 2001). The establishment of privately-owned, tradable property rights is important for the creation of conditions for individuals to have opportunities and incentives to develop and use the resource efficiently, or transfer it for more efficient uses (Frederick, 1993).

# 4 INDEPENDENT REGULATORY AGENCIES

## 4.1 What is an independent regulatory agency (IRA)?

An independent regulatory agency is a public authority or government agency responsible for exercising autonomous authority over some area of human activity in a regulatory or supervisory capacity. A distinguishing characteristic of an independent regulatory agency is its independence from other branches or arms of the government. Such agencies can take different organisational forms and have different responsibilities, powers and duties.

## 4.2 What do IRAs do?

Typically in the case of the water sector, IRA's are tasked with regulating and facilitating judicious, sustainable and equitable management of water resources and supplies. As such, functional tasks can include: determining entitlements; identifying appropriate mixes of regulatory instruments; setting tariffs; adjudicating over bulk transfer disputes; and, addressing other concerns such as water conservation, inter-sectoral competition for water and management of demand for water. TERI (2010) lists additional functions and tasks such as: monitoring adherence to official guidelines; providing a link between government, water utilities and consumers; and, monitoring standards of water services delivery. The 2012 Rajasthan Water Regulatory Bill envisages that a Rajasthan Water Regulatory Authority will have a long list of powers, functions and duties (the full list can be found in Annex 1).

## 4.3 What is the rationale behind IRAs?

Arguments for establishing water-sector IRAs include:

- It is believed that the establishment of an IRA, which comprises of technical and economic experts working outside government, will ensure rational decision-making. It is expected that independent regulation will depoliticise the process of decision-making and enhance the techno-economic rationality of decisions that are taken;
- Being technical and economic experts, it is assumed that regulators will have sound knowledge of the water sector that will enable them to effectively assess the ability of water supply systems to meet multiple demands for water in space and time (PRAYAS, 2009). It is also assumed that the IRAs will make rational decisions regarding, for example, water rights and/or conflicts over limited water resources;
- Similar to above, it is assumed that IRAs will make decisions based on evidence provided by, for example, state-wide monitoring systems rather than on intuition or political whims.
- Since IRAs are independent of government and its agencies, it is assumed that they will take a long-term view of water-related challenges whilst keeping watchful eye for potential externalities and trade-offs linked to activities or interventions aimed at solving or addressing these challenges;
- It is also assumed that the structures created for stakeholder participation in decision-making processes will enable the regulators to understand and take account of the views of water users or their representatives when taking decisions;
- It is believed that accountability of IRAs can be assured by robust procedures that bring transparency and public participation into the functioning of the IRAs. It is believed that mandatory provisions to ensure transparency and accountability will also ensure that decisions are made in a fair and just manner (PRAYAS, 2009);
- It is assumed that IRAs will provide assurance to private investors, whether these be farmers investing in a bore well or commercial companies investing in facilities that

require dependable supplies of water of a certain quality, that ad hoc decisions will not have an detrimental impact on their investments;

- Finally, it is expected that IRAs will monitor and make important decisions with regard to water services providers – public or private – and regulate them in order to protect the interests of water users/consumers.

## 4.4 What is the status of IRAs in India?

Electricity IRAs have a track record of approximately a decade in India, with regulators operating in almost all states. In contrast, progress on the establishment of water sector IRAs has been very slow. The first-ever state-level water-sector IRA was established in the Indian state of Maharashtra in 2005 (Box 2 presents an overview of the 2005 Maharashtra Water Resources Regulatory Authority, Act). Similar legislation has been enacted in Arunachal Pradesh, Uttar Pradesh and Andhra Pradesh but, to date, Maharashtra is the only state to set up a functioning water-sector IRA.

**Box 2: Overview of the 2005 Maharashtra Water Resources Regulatory Authority Act (after, Vishwanath, 2011).**

The Maharashtra State Water Policy prescribed the setting up of two major regulatory instruments: (i) A state water resources regulatory authority and (ii) An act to authorize farmers' management of irrigation systems. Accordingly, the state passed and adopted the Maharashtra Water Resources Regulatory Authority (MWRRA) Act in 2005. Under the MWWRA Act the Maharashtra Water Regulatory Authority is supposed to regulate the state's water resources by engaging in tasks that include: a) Facilitating and ensuring judicious, equitable and sustainable management, allocation and utilisation of water resources; b) Fixing water rates for agriculture, industrial, drinking and other purposes; and c) Performing matters connected therewith or incidental thereto.

The Maharashtra Water Regulatory Authority is also the designated authority for issuing bulk water entitlements (BWE) to WUAs or other entities. The MWRRA Act also lays down the criteria for allocation and provision of BWEs issued based on the category of use subject to the priority assigned. BWEs are issued for uses, such as irrigation, drinking, municipal and industries to relevant user entities, mainly WUAs and others and not to individual farmers *per se*. Individual water entitlements are issued only for the construction and operation of individual lift-irrigation schemes using surface or sub-surface water sources. In all cases the BWE are measured volumetrically and with respect to timing and flow rate of delivery. The Act also proposes criteria in matters of transfer or trading of water entitlements.

With regard to the fixing of tariffs, the MWRRA Act includes various incentives and concessions for the agriculture, industry and drinking water sectors. These include: (i) Relief to economically weaker social groups including marginal and tribal farmers; (ii) Encouragement to adopt micro-irrigation techniques; (iii) Encouragement to adopt recycling by industries and usage of treated effluent for irrigation.

## 4.5 Are the challenges of water-sector IRAs different?

The consensus is that the social, political, economic and environmental stakes in water regulation are greater than, for example, in electricity regulation. It is also clear that there is a profoundly political element to the way in which water is governed, regulated and allocated. As such, water governance and regulatory systems almost always reflect the political realities at the national, state, district and local levels. So whilst neo-liberals may argue the case for removing the constraints which prevent the operation of a market-based economy and of minimising the role of government, it is somewhat naïve to think that water regulation and allocation can or even should be based entirely on techo-economic criteria. It is also clear that, as water scarcity increases the politics of regulating and allocating water increases.

## 4.6 Who is promoting water-sector IRAs?

Water sector IRAs have been included in GoI policy, for example, the report by the 'Expert Group on Water Resources' appointed by the Planning Commission (GoI, 2006) and in the draft 2012 National Water Policy (GoI, 2012). However, IRAs have also been promoted in India by international agencies, for example, financial provisions and conditionality pertaining to the establishment of IRAs has been part of many water sector projects funded by the World Bank in different Indian states. (World Bank, 2005 and 2006; Briscoe and Malik, 2007). In the case of Rajasthan, establishment of a water regulatory authority is both part of the 2010 Rajasthan State Water Policy and the Financing Agreement between the GoR and the European Union that determines the timing and size of fund releases to the SPP. More recently Shah (2013) reported the following:

*"As part of the Twelfth Plan, a model bill for state water regulatory system has been drafted. This draft is based on a thorough study of latest international thinking on regulation as also the experience of the Maharashtra Water Resources Regulatory Authority (MWRRA). The draft bill tries to resolve the conflicting demands of autonomy and accountability brought into sharp relief by the Maharashtra experience. It does so by proposing a regulatory system with inter-related but separate institutions that handle distinct governance functions. The bill proposes a separation of the authority to make "political" or 'normative' decisions and the authority to make "technical" or "predominantly non-normative" decisions. Thus, the State Water Regulatory and Development Council (SC) is expected to ensure accountability by providing the "normative" or "political" framework for the techno-economic regulatory decisions of the State Independent Water Expert Authority (SIWEA). The SIWEA will, in turn, be accountable to technical experts through the mechanism of regular peer reviews."*

An indication of the role and leverage of international agencies in establishing the Maharashtra WRA is provided by the sequence of events around the passing of the 2005 MWRRA Act. This act was passed in Maharashtra's state legislative assembly on the last day of the session through voice vote, without much discussion on the revised draft. A large World Bank loan for water sector improvement was sanctioned by the Bank's board immediately after the Act was passed.

## 4.7 What are the main concerns relating to water-sector IRAs?

Many authors have examined the long-term implications of establishing IRAs in the Indian water sector (e.g. Dubash, 2008; PRAYAS, 2009; TERI, 2010; Vishwanath (2011), Wagle and Warghade (2011)). Concerns include the following:

- **Democratic accountability and legitimacy:** Given that IRAs are independent of government, many authors have questioned their democratic accountability and legitimacy. Especially when making politically-charged decisions relating to, for example, water entitlements or water tariffs. Put more simply, members of IRAs are not elected nor do they have to account for their decisions in front of a democratically-elected assembly.
- **Transparency:** Clearly, IRAs should ensure transparency when exercising power and discharging functions. It is claimed that, in practice, the provisions related to transparency and direct public accountability of IRAs can easily be by-passed. Hence the combination of enormous authority in the hands of a few people without corresponding transparency accountability becomes very dangerous.
- **Capacity of IRAs:** The process of de-politicisation of decision-making implied in the IRA model is regarded by many as being dangerous in part because water-sector IRAs tend to be staffed mainly by retired government bureaucrats and technocrats with backgrounds in engineering and economics. As a result, IRAs have capacity limitations with regard to the range of disciplines that are represented. As worrying, there is the risk

that IRA members will believe that techno-economic rationality alone is sufficient for resolving complex socio-political issues. There is the risk also that IRA member will have a "leave it to the experts" mentality and, as such, they will be unwilling to listen to stakeholders when identifying optimal solutions to problems.

- **Stakeholder participation**: There is often limited scope for stakeholders, especially the poor and marginalised, to be heard during decision-making processes that could have a major impact on their access to water for different uses. It is argued also that the quasi-judicial nature of WRAs is responsible for alienating people, particularly the poor and marginal, from participating in decision-making processes.
- **Gender mainstreaming:** It is usual for IRAs to be staffed by men and take only limited account of gender issues. It is also the case that legislation related to regulation and allocation of water tends to be gender blind. Or put another way, legislation gives limited attention to: the role of women in water management; the potential impacts decisions taken by IRAs on women or the role of women in the IRA's decision-making processes.
- **Normative framework:** It is argued that IRAs are being set up in developing countries without evolving the normative framework within which they will operate (e.g. PRAYAS, 2009). In the absence of any normative framework, people will have to depend on the fairness and willingness of individual regulators to consider social and environmental aspects when taking decisions.
- **Water rights:** Creation, management, and regulation of a water entitlement system (WES) is often at the heart of the regulatory framework used by IRAs. As part of WES, various water users and groups of users are allotted certain shares of water as their 'water entitlement'. In the case of Maharashtra, there is concern that water will be made available only to those people who have land in command areas and it will be in proportion to the landholding. As such, the water rights of landless communities, including land tillers, agriculture labourers, and women cultivators will be totally ignored.
- **Cost recovery:** There is a concern that cost recovery will be used as the primary principle for determining tariffs and that little attention will be given to affordability. Thus, a new tariff regime will be based on commercial principles such as cost recovery and reduction in cross-subsidy. Such a move to commercialize the water sector is likely to have a detrimental impact on the poor and the agro-based rural economy of the nation. This will put the price of water services beyond the paying capacity of the poor and marginalized sections of society.

## 4.8 IRA-related Recommendations

The following recommendations relate to the establishment of a water sector IRA in Rajasthan:

- **Learn from existing IRAS:** The MWRRA Act is often proposed as a model regulatory act for replication by other states. However as discussed above, this appears to have some shortcomings. Hence it is recommended that, before a Rajasthan IRA is established, lessons are learnt from Maharashtra and elsewhere. Clearly it is desirable that Rajasthan's IRA legislation be grounded in local discourse and local demands and challenges facing Rajasthan's water sector. Similarly principles, processes and mechanisms within the legislation should be discussed and debated widely among the various stakeholders, including the non-dominant stakeholders.
- **Water governance:** IRAs must conform with principles of good governance e.g. the IRA must be accountable and procedures and processes must be transparent; there should be a high-level of stakeholder participation and/or representation. Stakeholder involvement, political priorities and even issues such as political interference and corrupt practices all have a major bearing on design of infrastructure and the strategic and day to day allocation of water for both domestic and productive purposes. Hence, systems of

effective water regulation and allocation are needed that ensure that all sectors of society have equitable, reliable and sustainable access to water. Clearly also mandatory provisions are needed that ensure unrestrained scope for transparency as a deterrent to unwarranted use of the discretionary power and unaccountable behaviour by members of of IRAs

- **Water rights:** Water entitlement systems should be equitable and take account of: environmental flows, rights and demands of future generations, polluting water uses and the potential consequences of external factors (e.g. climate change). Particular attention should be given to potential capture of water resources by elites or powerful sectors via tradable water rights.
- **Wide range of regulatory instruments**: As discussed elsewhere in this report, IRAs should promote and use a wide range of regulatory instruments including direct control (i.e. the focus should not necessarily be on financial instruments). A core responsibility of IRAs should also be to match regulatory instruments to different contexts and to continually monitor the effectiveness of these instruments.
- **Monitoring systems:** For IRAs to do their job well, they need access to reliable up-to-date information on: the status of water resource availability in time and space; the condition of water storage and supply infrastructure; patterns of water demand and use by different sectors; and, the functionality of water governance systems. Hence systems need to be in place to ensure this information is made available in a form that meets the requirement of the IRA.
- **Conflict resolution:** Given the multi-dimensional nature of water and the fact that conflict over water can evolve at every level from the inter- or intra village levels to the inter-state level, there is a strong argument for developing a regulatory system comprising of decentralized nested institutions rather than total reliance on an apex level authority.
- **Gender, livelihood and environmental audits:** Finally, it is recommended that IRA legislation and proposed IRA processes, procedures and recommended are routinely subjected to gender, livelihood and environmental audits. The aim being to ensure “non-monetary” aspects of water regulation and allocation are kept in mind when decisions are made.

# 5 DISCUSSION

*Water management:* Conventional approaches to managing surface and groundwater resources emphasise the need for sustainable management at the basin or aquifer scale, defining sustainability in terms of the long-term balance between replenishment and depletion. In theory, assessing the hydrology and hydrogeology of a basin and/ or aquifer and ensuring that policies and practices do not lead to a significant imbalance between supply and demand sustainable management is achieved. Conventional command and control approaches to water management often use a combination of legal, regulatory and pricing mechanisms to balance availability with extraction and depletion often at different spatial and temporal scales. They generally do not focus on the deeper social, cultural and political incentives that drive and shape water demand; neither do they consider, in any detail, the influence or importance of inter- sectoral competition and conflicts. Theory aside, water management planning is more likely to be based on hydrological units (e.g. river basins) rather than hydrogeological units (e.g. aquifers). This is even in states such as Rajasthan that rely heavily on groundwater availability to meet demands of different users and uses.

Beyond, this common starting point, however, views of different stakeholders of water management begin to diverge (COMMAN, 2005). Some, particularly those with training in water management, emphasise the need for comprehensive and integrated approaches based on formal systems of water rights, economic signals and regulatory controls. Politicians are presented with proposed reforms that entail heavy technical and institutional requirements (e.g. institutional restructuring at different levels; new legislation; creation of water regulatory authorities, WUGs and IWRM teams etc) that are at odds with existing procedures and that can confront long-establishment power relations and patterns of access to and use of water. Popular resistance to such reforms when combined with the formidable challenge of metering and administering millions of water (and/ or power) users makes them politically unpalatable8. It is not surprising that less politically challenging interventions such as augmenting supply and increasing efficiency of use within existing sectors are favoured (COMMAN, 2005).

*Regulation and demand management:* India and, more specifically, Rajasthan have a long history of managing scarce water resources. Also many lessons have been learnt particularly from NGO programmes on what is needed to generate support for and buy-in to programmes that, amongst other objectives, attempt to regulate water use in rural areas. Similarly, there are examples of regulatory instruments being used to manage demand within urban areas. However despite considerable effort, arguably there are no recent examples in Rajasthan or India of regulatory instruments being used successfully at scale (both time and space); to restore the balance between renewable water resources and demand; to improve the security and equitable access to water services received by rural and urban users; and, to improve the efficiency and productivity of water use by all sectors at all scales. Of greater concern is the fact some regulatory instruments that are heavily promoted by many government programmes are having the perverse impact of increasing water use per unit area or per land holding (Batchelor et al, 2012). Hence, the GoR does not have a regulatory model from elsewhere in India that can be easily copied and/or adapted.

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[8] In a case study of the Kheda and the Mehsana districts of Gujarat, Shah and Bhattacharya (1996) concluded that performance of tube well companies has been better than tubewell cooperatives due to design concept based on parameters of self- governance. Informal user organizations to which public tube wells have been transferred also emerged with visible success. Such hybrid forms of user organizations which had combined features of water user association and irrigation service markets need to be revisited before they could be recommended for large scale replication. But, groundwater resources are under severe strain and no viable solution has emerged.

The SWP is a good starting point but the current emphasis of the SWP and SWPAP is on the metering of all large scale water uses and uses and the implementation of a tariff regime. However, recommendations of this study include:

- The SWP and SWPAP should consider using a much wider range and pragmatic mix of regulatory instruments than is currently the case. It is also recommended that the selection of regulatory instruments is carefully matched the characteristics different groups of water users and uses.
- Volumetric metering of individual agricultural water users has proved to be problematic worldwide[9]. It is likely to be even more challenging in Rajasthan given the nature and characteristics of the informal water economy (Shah, 2011). It is recommended therefore that volumetric metering be used in urban areas, but for agricultural water users the focus should be on metering the electricity used for pumping water alongside a system of intelligent rationing of power supplies. This means that alternative instruments will have to be used for gravity-fed irrigation systems.

*Pre-eminence of engineering solutions*: Whilst the SWP and SWPAP recognise the fundamental need for regulation and management of demand, it is clear that political and public opinion and the view of the media, NGOs and most government staff working in the sector is still firmly that solutions to Rajasthan's water problems lie in more engineering whether these solutions should be more recharge structures or major inter-basin transfer schemes. Or put another way, rather than viewing engineering as being a part of the problem, the belief is that even higher expenditure on engineering will overcome the current imbalance between supply and demand. Others are convinced that this imbalance can easily be overcome via improvements in water use efficiency. This common misconception has been a cause for ill-conceived policies and government expenditure all around the world (e.g. Molle and Turral, 2004; Perry, 2007; Molle and Berkoff, 2007; Clemmens *et al*, 2008; Ward and Puldido-Velazques, 2008; Crase and O'Keefe, 2009).

*Consumptive and non-consumptive water uses:* Water conservation and saving technologies (WCTs) are touted widely as an effective means of improving water use and irrigation efficiency and freeing up water for alternative uses (e.g. Clemmens *et al*, 2008; Ward, and Puldido- Velazques, 2008; Ahmad *et al*; 2007)[10]. Support for WCTs is based, to

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[9] The volumetric use right of individuals or "entitlements" can be defined and established by the government agency concerned using a variety of social and economic parameters. A user who needs more water than the actual entitlement can purchase the water rights from another user by paying prices determined by the supply-demand interactions. The price of water will reflect the opportunity cost of its use. The markets and market determined prices could work in two ways: they make farmers shift to alternative uses that provide higher economic returns than the price of water; or continue the existing uses with more efficient practices or else resort to sell (Frederick, 1993). Such transfers can promote access equity and efficiency in use (Kumar, 1997; Kumar, *et al,* 1999; Kumar, 1999/2000). Tradable private property rights need to be enforced for groundwater and water supplied from public reservoirs for irrigation. In the case of groundwater and canal water supplied for irrigation, as individuals enjoy access to the resource, private property rights for individual users are envisioned. For markets to function efficiently, the full benefits and costs of transfer should be borne by the seller and the buyer. Generally, this is not possible due to the third party effects of water transfer. Allowing the user to transfer only the consumptive portion of the water he uses can reduce the third party effects in dry regions. The government will have to play a great role in reducing the third party effects of water transfers. Similarly, the government has to invest in protecting the ecological and environmental services that are affected by water transfers (Frederick, 1993). Fixing norms for the allocation of volumetric water rights across individual sectors, viz., agriculture, industry and domestic use, should involve considerations such as the physical sustainability of the water resource system and the environmental sustainability. The total water allocated from any region/basin, therefore, should not exceed the difference between the annual renewable freshwater and the ecological demand, or the utilizable freshwater whichever is less.

[10] Designing appropriate water-saving irrigation systems needs critical analysis of current financial incentives provided through power and electricity and diesel oil supplies; price support to the water incentive crops vis-a-vis

some extent, on a widely-held view that most irrigation schemes are marred by inefficiencies that are in the range 30-40 per cent. Hence conventional wisdom, particularly in areas of increasing water scarcity, is that water can be freed up for other uses simply by increasing water use and irrigation efficiency (Molle and Turral 2004; Seckler *et al.* 2003; Crace and O'Keefe, 2009). However, there is no getting away from the fact that, in this case, conventional wisdom is ill-conceived when applied to irrigation water use at the system or basin scale (e.g. Molle and Turral, 2004; Perry 2007; Turral, 2011). The root cause of this situation lies in confusion over issues of scale and what constitutes real water savings at the irrigation system or basin scales. The simple fact is that some of the water that is claimed to be 'saved' by WCTs would have percolated into the groundwater from where it can be accessed and reused by farmers. Similarly, farmers or other users often use some of the run- off that is have been possibly "saved" downstream. Perry (2007) traces the development and use of various irrigation efficiency concepts back to the classical irrigation efficiency concepts developed in the 1950s. Israelson (1950) defined irrigation efficiency as the ratio of the water consumed by crop to the water diverted to irrigate a crop and, despite later modification, this ratio has remained the underlying basis for estimating irrigation efficiency ever since.

**Table 5.1 IWMI Water Use Framework (after Turral, 2011)**

<table>
<tr><td rowspan="2">Consumptive water use</td><td>Beneficial</td><td>e.g. evaporation from irrigated or rainfed crops (but not from bare soil)</td></tr>
<tr><td>Non-beneficial</td><td>e.g. evaporation from lakes, reservoirs or irrigation channels, evaporation from bare soil or weeds</td></tr>
<tr><td rowspan="2">Non-consumptive water use</td><td>Recoverable</td><td>e.g. drainage to groundwater, treated urban wastewater, return flows from irrigated areas, fish farming, environmental flows in rivers that do not flow into the sea</td></tr>
<tr><td>Non-recoverable</td><td>e.g. water flowing to the sea, water polluted to the point that cannot be treated at an economic cost</td></tr>
<tr><td rowspan="2">Change in water storage</td><td>Negative</td><td rowspan="2">e.g. change in reservoir storage, change in groundwater levels, change soil moisture deficit.</td></tr>
<tr><td>Positive</td></tr>
</table>

Importantly, the classical concept of irrigation efficiency ignored the potential for return flows and recycling of water "lost" as drainage. Later contributions to the debate emphasised the use of ratios or fractions to describe water use and to explicitly consider the impact of return flows (e.g. Jensen 1993; Willardson 1994; Allen *et al*. 1996, 1997; Clemmens *et al*, 2008; Ahmad *et al*, 2008). According to the revised definitions of water use (see Table 5), water diverted for irrigation can be divided into the consumed fraction, comprising beneficial consumption (e.g. intended purposes that include environmental flows) and non-beneficial consumption (e.g. evaporation from bare soil and weeds). The remainder was classified as the non-consumed fraction and this comprised two groups- recoverable flows and non-recoverable flows. Note that the water use framework in Table 5 also includes changes in

water saving crops and disincentives to the diversification of cropping system, revising existing groundwater laws to control mismanagement of groundwater, strengthening the role of cooperatives or group-oriented systems, adoption of river basin approach are the some ways to control externalities connected with groundwater (Joshi, 2002; Shah, 1993; Dhawan, 1995; Vaidyanathan, 1996; Saleth, 1994; Marothia, 2003). However, since these measures have not found sufficient ground in current political economy, thus the groundwater resources continue to be degraded one or the other way almost in every part of India.

water storage. This is because changes in water storage should not be left out of irrigation efficiency calculations as this can and often does result is misleading interpretation of efficiency-related information (e.g. Ahmad *et al*, 2008).

In summary, not all the water purportedly 'lost' from an irrigated field or an irrigation scheme constitutes a loss to the hydrological system as a whole. Gyles (2003) argues that confusion over water savings arises from '…*errors in logic and the inability or reluctance of the promoters* (of WCT) *to view water flows in a systems context'*. However if the intent of a WCT programme is to 'save' water or to free it up for other uses, it is vital to know whether the 'losses' from an irrigation scheme or a farming system are in fact losses at all (e.g. Crase and O'Keefe, 2009). From a regulatory viewpoint it is also vital to differentiate (in time and space) between consumptive uses and non-consumptive uses that are recoverable if the aim of a regulatory system is to ensure that maximum benefit is gained per unit volume of water.

*Regulatory institutions*: The availability of water, and peoples' access or lack of access to it, is ultimately a function of the effectiveness of policies and institutions (Merrey and Cook, 2012). Similarly, the productivity of water is a function of institutional incentives and support systems. Without positive incentives and support, new technologies and practices will not be adopted and used effectively. The institutional challenge is to find effective means to collectively manage shared water resources in a way that optimises the benefits to people, is perceived as fair and equitable by the participants, and sustains the resource so that its benefit streams are available to future generations. This is a fundamental problem facing Rajasthan that occurs at all scales, from small local communities managing a micro-watershed, to large-scale irrigation schemes, to river basins including large transnational ones.

There are, however, no universal models or panaceas that can be applied or adapted to solve institutional problems (Merrey *et al*, 2007; Mollinga *et al*, 2007). As such there is a growing body of literature demonstrating the limitations of transferring 'successful' models of governance to entirely new contexts (e.g. Merrey and Cook, 2012). It is not that lessons cannot be learned through the comparative study of, for example, river basin governance; rather the development of effective institutions and policies should be viewed as a negotiated process involving civil society and the state (Merrey and Cook, 2012). Pritchett *et al* (2010) take this argument a step further by arguing that for certain development problems the quest for *the* solution is itself the problem, and this is especially so in matters pertaining to political, legal and organizational reform, where combinations of high discretionary decision-making and numerous face-to-face transactions are required to craft supportable solutions.

Pritchett *et al* (2010) attempt to explain how governments manage to engage in reform processes yet consistently fail to acquire capability. They suggest that two reasons stand out:

- First, reform processes encourage progress through importing standard responses to predetermined problems. This encourages *isomorphic mimicry* as a technique of failure: the adoption of the *forms* of other functional states and organizations, which camouflages a persistent lack of *function.*
- Second, an inadequate theory of developmental change reinforces a fundamental mismatch between expectations and the actual capacity of prevailing administrative systems to implement even the most routine administrative tasks. This leads to *premature load bearing*, in which wishful thinking about the pace of progress and unrealistic expectations about the level and rate of improvement of capability lead to stresses and demands on systems that cause capability to *weaken* (if not collapse).

Whilst this analysis is generic and not directly applicable to the water sector in Rajasthan, the design of the SPP and the water sector reform process has been based on importing standard responses from outside Rajasthan. Arguably also the institutional development that is being promoted by the SPP is based more on isomorphic mimicry than an organic process that takes Rajasthan's bio- physical, political and socio-cultural context as a starting point.

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# ANNEX 1: Proposed powers, functions and duties of Rajasthan Water Regulatory Authority[11]

*Powers, functions and duties of the Authority.-The Authority shall exercise the following powers and perform the following functions, namely:-*

a. *to determine the distribution of entitlements for various categories of use and the equitable distribution of entitlements of water within each category of use on such terms and conditions as may be prescribed;*
b. *to enforce the decisions or orders issued under this Act;*
c. *to determine the priority of equitable distribution of water available at the water resource project, sub-basin and river basin levels during periods of scarcity;*
d. *to establish a water tariff system, and to fix the criteria for water charges both for irrigation and drinking water after ascertaining the views of the beneficiary public, based on the principle that the water charges shall reflect the full recovery of the cost of the operation and maintenance after duly accounting for the inefficiencies of the delivery system so that the cost of inefficiencies are not passed on to the beneficiary;*
e. *to administer and manage inter-state water resources apportionment on river systems, of the State;*
f. *to review and clear water resources projects proposed at the sub-basin and river basin level to ensure that a proposal is in conformity with Integrated State Water Plan and also with regard to the economic, hydrologic and environmental viability and where relevant, on the State's obligations under Tribunals, Agreements, or Decrees involving inter-state entitlements;*
g. *to fix the criteria for trading of water entitlements or quotas on the annual or seasonal basis by a water entitlement holder. These criteria shall among others include the following:-*
    i. *entitlements except aggregate bulk water entitlements are deemed to be usufructuary rights which may be transferred, bartered, bought or sold on annual or seasonal basis within a market system and as regulated and controlled by the authority as established in the regulations of the Authority; and*
    iv. *quotas of water determined by the seasonal or annual allocation assigned to an entitlement shall be volumetric usufructuary rights which may be transferred, bartered, bought or sold on an annual or seasonal basis within a market system as established and controlled by the regulations of the Authority;*
h. *entitlement may be subject to review at intervals of not less than three years and then only if warranted by concerns about, the sustainability of the level of allocation except in exceptional circumstances;*
i. *in the event of water scarcity, the Authority, in compliance with its policy and rules for allocating such scarcity, shall adjust the quantities of water to be made available to all entitlements and shall permit the temporary transfer of water entitlements between users and categories of users;*
j. *to establish regulatory system for the water resources of the State, including surface and sub-surface waters, to regulate the use of these waters, apportion the entitlement to the use of the water of the State between water using categories;*
k. *to establish a system of enforcement, monitoring and measurement of the entitlements for the use of water to ensure that the actual use of water, both in*

[11] Source: 2012 Rajasthan Water Regulatory Bill. As of date, this bill is under scrutiny from the standing Committee of the Rajasthan Legislative Assembly.

*quantity and type of use are in compliance with the entitlements as issued by the Authority;*

l. *to administer the use and entitlement of water resources within the State in a manner consistent with the State Water Policy to ensure the compliance of the obligation of State with regard to the apportionment of inter-state waters between the State and other States;*

m. *to promote efficient use of water and to minimize the wastage of water and to fix reasonable use criteria for each category of use;*

n. *to determine and ensure that cross-subsidies between categories of use, if any, being given by the Government are totally offset by stable funding from such cross-subsidies or Government payments to assure that the sustainable operation and maintenance of the water management and delivery systems within the State are not jeopardized in any way;*

o. *to develop the State water entitlement data base that shall clearly record all entitlements issued for the use of water within the State, any transfers of entitlements and a record of deliveries and uses made as a result of those entitlements;*

p. *to facilitate and ensure development, maintenance and dissemination, of a comprehensive hydro-meteorological information data base;*

q. *the Authority may review and revise the water charges after every three years;*

r. *the Authority may ensure that the Irrigation Status Report is published by the Government every year. Such report shall contain all statistical data relating to irrigation including details in respect of district-wise irrigation potential created and its actual utilization; and*

s. *to prescribe service standards for the service providers of water with prior approval of the Government and ensure compliance of these standards.*

t. *As and when necessary Authority may constitute a Advisory Committee(s) to assist or advise it on specific technical and other matters.*

u. *to impose penalty on any organization or agency, whether Government or private; any individual or a group of individuals who changes, alters or cause to change or alter the states of any surface resources without the specific sanction or approval of the authority;*

v. *to encourage the masses/users about re-cycling and re-use of water.*

w. *to impose the complete ban on encroachment on water bodies.*

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