CHAPTER 6

CRITICAL EVALUATION OF CLUSTER STORAGE STRATEGY FOR VILLAGE WATER DISTRIBUTION SYSTEM OF RRWSS

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This chapter mainly discusses a thorough review for the concept of Cluster Storage Strategy (CSS) against the functioning of conventional system, which includes Elevated Service Reservoir (ESR) and Stand Post (SP) or individual piped connection as village water distribution system. The present Study is a review on the functioning of CSS in several villages of the state of Gujarat, which is carried out by means of technical data evaluation and the study of social impacts including villagers' perception and expectations gathered during field visits. The output of a study is useful in scaling-up of such systems for other village water distribution systems in most developing countries too.

6.1 Background

Rural water supply system in developing countries is designed to cater demand of potable water to communities for domestic purposes such as drinking, cooking, bathing and hygiene. This requires supply of high-quality water on a sustainable basis. In the developing world, families (especially women in India) spend a considerable amount of time trying to get sufficient water for these uses. The potable water supply system usually comprises traditional sources of water, such as rivers and open wells, which are often contaminated and distant from the household. Improved rural water supply systems include a range of technologies from protected wells equipped with manually operated hand pumps to more complex gravity-flow or pumped piped water systems connected to houses or Elevated Service Reservoir (ESR) and Public Stand Posts (SP's): often the case in RRWSS. The technical solution is very location

specific and will depend on a range of characteristics such as community demand, affordability and willingness to pay, community size and household density, water resources and electricity availability, and topographical issues.

The traditional village water distribution system in RRWSS often includes an Elevated Service Reservoir (ESR) & Stand Post (SP) or individual piped connections. It is common that the villages with population less than 3000 and limited water availability consist of SP's as village distribution system, while the villages with population greater than 3000, good economic developments and sufficient water availability consist of individual piped connections. Either of these systems stores the total water requirement into an underground sump near ESR and this water is then pumped to the ESR. Later the stored water in ESR is distributed in various time zones to different parts of village through SP's or individual house-to-house connections.

It is often noted that the traditional piped water distribution through ESR & SP or house-to-house connections system is susceptible to various disputes like disparity in distribution, deficiency of pressure & untimely supply hours. To address such issues, an alternative strategy 'Cluster Storage Strategy (CSS)' has been implemented in several villages of Gujarat state with the collective efforts of UNICEF, WASMO & GWSSB in past decade. In CSS, water is received from RRWSS or local source is directly pumped for distribution to the storage tanks located among the small clusters or hamlets of families residing together. Capacity and placement of storage tanks, within a cluster can be worked out based on the topography and population to cater with design norms of supply of individual at 70 lpcd. These tanks would act as transformers in water distribution system. On one hand, they will secure the required quantitative share of the community in the cluster storage tank, and on the

other hand also protect the excessive withdrawal by other clusters. In short, each cluster or household gets equitable water supply and thus also serves the intended purpose of social inclusion.

6.2 Methodology adopted for evaluation of CSS

Desk study of documents developed by the UNICEF, WASMO & GWSSB was carried out and the technical design of the alternative distribution systems was carried out. To understand whether the CSS functions or not, seven villages of two districts, Surendranagar & Kachchh were considered under the study. Based on the influencing factors such as population size, variation in caste & inter-caste conflict issues, availability of water, topography of the area, economic conditions in terms of agricultural and industrial growth in and around village and the success observed in CSS model, villages are grouped and summary of their main features is as shown in Table 6.1. Interactions with village people including household women, Pani Samitis of village & NGO working in the area were carried out.

Table 6.1 Showing Details of Different Villages and Their Features Under Study Area

Name of the Village/feature	Village Groups						
	Group A		Group B		Group C		
	Village: Khintla District: Surendranagar	Village: Mokasar District: Surendranagar	Village: Paddhar Taluka Bhuj District: Kachchh	Village: Dhori Taluka Bhuj District: Kachchh	Village: Hodko District: Kachchh	Village: Nana Bandha District: Kachchh	Village: Ghadiyado (Banni) District: Kachchh
Population	330 families, @2300 persons	260 families @1250 persons Located in Clusters	457 Families, @2159 people	1200 Families, @4200 people	100-120 families, @450 people – Scattered population	45-50 families, @200 people – Scattered population	60 families, @250 people – Scattered population
Topography of village	Low to High Elevation (Uneven)		Flat to slightly downward from source		Flat		
Main Business	Agriculture		Agriculture, Animal Husbandries, Labor	Agriculture, Animal Husbandries, Handicraft (Bharatkam)	Animal Husbandries, Handicraft (Bharatkam)		
Caste Variations	Koli , Darbar, Harijan, Rabari, Vaghari, etc.	Koli , Darbar, Harijan, Rabari, Vaghari, etc	Aahir, Rabari, Muslim, Bawa, koli	Aahir, Harijan, Darbar, Kapadi, Bawaji,	Muslims, Rabari		

Name of the Village/feature	Village Groups						
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	Village: Khintla District: Surendranagar	**Village: Mokasar District: Surendranagar**	**Village: Paddhar Taluka Bhuj District: Kachchh**	**Village: Dhori Taluka Bhuj District: Kachchh**	**Village: Hodko District: Kachchh**	**Village: Nana Bandha District: Kachchh**	**Village: Ghadiyado (Banni) District: Kachchh**
				Lohana			
Availability of Water	Medium to Scarce in summer		Medium to sufficient throughout the year		Scarce through most part of the year except monsoon (desert area)		
Source of Water	RRWSS based on source water from Nimdi Dam (@ 2 KM length of Pipe line)	Bore well & Check dam (for recharge) near it	Bore Well (with 80,000 lit capacity sump)- @ 4 km away from village and RRWSS	RRWSS based on Bore well	RRWSS, based on Narmada Water Pipe line		
Whether CSS successful or not?	Yes- Most successful		Redundant- As House-to-House connection allotted in some continents and multiple schemes of water supply exists with sufficient water availability		Yes		

6.3 Observations and Findings

The outcome of the study is separated in two groups, namely 1. Techno-Economic Aspects and 2. Social Aspects.

6.3.1 Techno- Economic Aspects

(i) Capital costs: While referring the capital cost for the infrastructure building of both CSS and ESR & SP system for a typical case of one village Paddhar as mentioned in Table 6.2, the traditional system would cost Rs. 8.08 lacs while the CSS would cost Rs. 8.80 lacs, i.e. the CSS is 9% more expensive if the tanks are of HDPE. However, if the cluster storage tanks were of masonry, then the CSS would cost Rs. 7.13 lacs, i.e. 11.7% less than the traditional system.

In case of CSS design, residual pressure requirement is substantially reduced over the conventional ESR & SP system. This reduces the capital cost of distribution pipes as well as it reduces the chances of frequent breakage in pipes. Also, wastage/loss of water due to breakage reduces to a great extent.

It was also noted during the field visits that wastage was very less in case where the Cluster Storage (CS) tanks are located underground. Because in such system water need to be fetched by the hand pump from the CS tank, while CS tank located on or above ground or in SP system, if 1-2 taps are broken (common case in most villages) then the wastage of water will be higher due to continuous leakages.

Table 6.2 Showing Comparison of Cost for the Infrastructure Needs in CSS versus ESR & SP

ESR & SP system components	CSS system components
SP with 4 taps – Each of Rs. 3500 X 8 nos. so, total = Rs. 28,000	16 SP with 2 taps each Rs. 2290 so, total = Rs 36,640
R.C.C. Tank 2 nos., each of 40,000 litres capacity (total 80,000 litres capacity) Each of Rs. 1,16,960 so, total = Rs. 2,33,920 (with sluice valve)	16 nos. Masonary Tanks Each 5000 litres capacity of Rs. 18,800 so, total = Rs. 3,00,000 (with sluice valve and ball cock) OR 16 nos. HDPE Tanks Each 5000 litres capacity of Rs. 29,230 So, total = Rs. 4,67,680 (with sluice valve and ball cock)
Distribution pipes P.V.C. material 2700 meter length so, total = Rs. 3,38,625	Distribution pipes of P.V.C. material 3000 meter length so, total = Rs. 3,76,000
ESR (25,000 litres capacity) = Rs. 1,37,500	Not Required
Under Ground sump R.C.C. (50,000 litres capacity) = Rs. 70,000	Not Required
Total = Rs. 8,08,045	**Total = Rs. 7,13,690 (22% less, if masonary tanks) OR Total = Rs. 8,80,570 (9% more, if HDPE tanks)**
Reference: Training Manual for Trainers of CSS, GJTI	

(ii) Operational costs: There does not seem to be much difference in the operational costs – as in most villages the main operational cost is that of a system operator. However, the real major operational cost is power, which is 100% subsidized by the Government. As far as power consumption is concerned, it would be assumed that pumping cost to high level ESR would be higher. Also, as experienced by the villagers in the

village Mokasar, the traditional system required frequent power use as different communities would want water at different times, while in the CSS; power was used only once to fill the CS tanks. It was also noted that the power saving (particularly in states where demand far exceeds supply) in CSS would be substantial over time.

6.3.2 Community Perception & Social impacts

Based on the visits to seven villages of study area, it was found that the CSS provides an equitable and socially inclusive drinking water supply in the village. In all these villages, those who were laborers, who were more remotely located and who were of the minorities/lower castes, all of them were enthusiastic about the CSS because it provided substantial water storage near their houses. Since the number of households accessing one tank is limited to maximum of about 25 to 30 households only, the chances of any conflict or domination were reduced considerably. In villages, since many of the scheduled castes live in hamlets, this decentralized storage system resulted in these groups getting their own cluster storage tank to manage, and have little dependency on the non-scheduled castes for accessing water.

In the traditional system, since the water supply is erratic (based on when the power comes and when the SP's get water from ESR), the households who do not go to the fields get better access, while laborers get less and later access. Since in CSS, the water is stored, the women can access it at any time – reducing the need to do excessive storage at the household level, and helping the laborers return home from work without much worry. In Kachchh also, where villagers go out for work, and distances are vast, this storage near the house provides relief to the women. Both pastorals and non-pastorals feel comfortable with the new system, as there is enough water for humans and cattle.

Women repeatedly mentioned how much time was saved, and in village Mokasar, the women who were farm laborers, specifically mentioned that since drinking water was available whenever they wanted in adequate quantities, it was a huge improvement in quality of their lives. Earlier, in the ESR & SP scheme, they had to rush from work (if working in nearby fields) during power supply duration as water was distributed from the ESR to the different SP's only during power supply periods. For those who went for labor further away from the main village, the women had to go out again in the evening after a full day's labor work to collect water from nearby wells or beg the village leaders to get the SP water started. In summer, it would be worse, as even local hand pumps/wells would be non-functional. In village Khintla the leaders mentioned that because the water was well chlorinated, illness has come down dramatically in the village and they estimated that there was a saving of Rs. 1.5 – 2 lacs annually in health costs! The nearby doctor in village Sudambda had started noticing that patients from village Khintla were reducing. In the village Hodko, where WASMO is piloting a solar panel based pumping system and CSS in each *vand* (cluster), women mentioned that there were less quarrels between them for water (earlier they would compete to access the water available for limited time). The women mentioned that 1.5 hours of time was saved daily. In village Khintla and Nana Bandha, women mentioned that earlier, even during the labor season, their capacity to work and earn more was limited by water availability and timings. Earlier they used to fill water at 9.30 a.m. and then only leave for work, now they leave for work at 7.30 a.m. as water is stored in CS tanks nearby and no individual storage is required.

In the Banni area of Kachchh, since their livelihood is based on cattle, the earlier limited and erratic water availability led to quarrels between the pastorals who need more water (for cattle) and those who

need water only for domestic consumption. Spending two to three hours daily for water was not unusual in this area. In village Ghadiyado, the villagers have made a modification to the cluster storage tank by diverting the water spilling down the hand pump to the cattle trough, so that there is no wastage at all. Villagers also experienced that milk production has increased because of the increased water availability.

6.4 Potential to Scale up in Village Water Distribution in RRWSS

It was noted that primarily, degree of success of CSS is highly dependent on the population size, variation in caste & inter-caste conflict issues, availability of water, topography of the area, and economic conditions in terms of agricultural and industrial growth in and around the village.

In case of villages (Group-A) located at higher elevation from the source, and the availability of water is medium (other than summer) to scarce (in summer), population size is medium or small and inter-caste conflicts are high and low to medium economic growth conditions, CSS model proves to be the most efficient.

In case of villages (Group-B) located in flat to slightly downward topography, and the availability of water is adequate throughout the year, population size is medium or high and no inter-caste conflicts and economic growth in terms of agricultural and industrial development is good, CSS becomes redundant as the water distribution system has been shifted from collective to individual. Like all technologies which change to match the societies needs for individual service (common landline to individual mobile, common flour mill to household flour unit etc.) in the large, relatively prosperous and semi urbanized villages of Padhhar and

Dhori of district Kachchh, the individual house connections has rendered the CSS redundant. As the villagers mentioned, the CSS was useful relative to the earlier ESR & SP, traditional system, and was used for about two years, but after individual connections were given, the CS tanks are of no use, except where there is common water use (temples etc.).

As per the technical evaluations, despite the minimal cost savings due to implementation of CSS in flat topography region, which is the case of villages (Group C), CSS prove to be quite efficient. However, in case of group C villages, scarce availability of water throughout the year and remotely located clusters of small size population were the main driving factors in making CSS most efficient.

Potential to Scale up Individual Piped Connections

The Villages where reliable source of water is available throughout the year, availability of sufficient water, high population density, flat or even topography and per capita income is high, there is a lot of potential to use individual piped connections for village water distribution.

Potential to Scale up ESR & SP

The Villages where reliable source of water is available for most period of the year, availability of sufficient water, medium population density, heterogeneous but relatively united communities, flat or even topography and per capita income is medium to low, there is a lot of potential to use ESR & SP system.

Potential to Scale up CSS

The semi arid region, where water availability is scarce, local source of water is non-reliable, low population density, villages with uneven topography, social structure is heterogeneous & with inter-caste conflicts, there is a lot of potential to use the cost effective CSS.