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AN ANALYTICAL REVIEW OF GROUNDWATER MARKETS IN THE SCARP TRANSITION NORTH ROHRI PILOT PROJECT AREA

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ABSTRACT

This case study was conducted in the SCARP North Rohri Pilot Project Area. The objective was to explore some of the key factors that undermine the potential benefits of groundwater markets. The literature review, which supplements study findings, demonstrates a mixed impact of groundwater markets in improving the performance of irrigation resource management. The study shows that while there is evidence of increase in cropping intensities, crop production and incomes, but the topographical, social, environmental and economic differences by regions are critical to successful promotion of groundwater markets.

REVIEW OF LITERATURE

Several researchers have identified active groundwater markets[1] as a means to improve performance of integrated management of surface and groundwater resources. Shah (1993), p.146 suggested that *"an active groundwater trading can minimize the harmful effects of in-equitable land ownership patterns (as in the case of the research area) by providing access to groundwater at competitive rates from the neighbouring farmers to those who can not afford to purchase costly tubewells"*. In other words, Shah confirmed the tendency of large farmers to dominate groundwater exploitation. Groundwater markets, he assumed, would encourage large farmers to trade (any

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[1] The term is also interchangeably used with groundwater trading.

surplus) water to resource-poor farmers who could not afford to install costly tubewells. Potentially a market in groundwater may also lead to overall gains in efficiency as selling water provides an opportunity cost to use of water on own land. Hence transfer of water to the most productive use in terms of value of output could be achieved. Gains in both equity and efficiency are the potential prize of groundwater markets. However, a number of practical problems and the issue of sustainability of aquifer use must be addressed before many gains can be realized.

It is mentioned that a farmer who sells tubewell water can recover fully or partially the tubewell's operational cost; he may also generate some extra amount, which can be used if the tubewell is damaged, a new bore-hole needed or for any other reason. In this regard, Meinzen-Dick (1996) suggested that there were clear productivity gains to farmers purchasing groundwater over those using only surface irrigation, he also reported that the gains much higher than those who only use surface supplies. Confirming these gains, Lowdermilk *at el* (1978) showed higher increase in the wheat and cotton yields fortubewell water purchasers as compared to those using only canal supplies (Table 1).

TABLE - 1
AVERAGE YIELDS OF MAJOR CROPS BY WATERCOURSE

Crop	Canal Only	Tubewell		
	Kgs./Acre	Public Kgs/Acre	Purchased Water Kgs/Acre	Owner Kgs/Acre
Wheat	672	747	784	896
Rice	522	709	784	829
Cotton	261	299	373	485

Source: Lowdermilk *et al* 1978.

A leading analytical assessment of groundwater markets was presented by Palmer-Jones (1997) who evaluated the role of water markets in terms of equity and productivity. At first, explaining the fundamental causes of emergence of groundwater markets, he reported that *"the failure of public or co-operative ownership and management of deep tubewells lead the privately owned shallow tubewells to play the major role in groundwater exploitation, and groundwater came to be distributed in what are called groundwater markets"*. He mentioned that recent policy prescriptions advocated privatisation of groundwater partly to facilitate these markets.

Water Markets in Sindh

Murray-Rust and Velede (1992) quoting groundwater trading in Pakistan, reported that the volume of water supplied by tubewells is critical for the cropping pattern. The *warabandi system,* which provides a fixed schedule of canal deliveries, does not allow farmers the flexibility to adapt applications to meet optimal crop water requirements. The potential to improve the timing of water deliveries is one of the great attractions of tubewell irrigation. The expansion of irrigation through groundwater markets has led to increase in cropping intensity and demand for agricultural labour, which ultimately benefits the landless and those who rely on wage labour for household income.

Meinzen-Dick (1996) reported that water markets operate in all provinces of Pakistan, but are most active in Punjab. She did not reason why water markets were so active in Punjab compared to other provinces in Pakistan, except that she mentioned that the greatest groundwater development had taken place in the province of Punjab. She did not explore other possible

factors such as, the scale of electricity supply needed to run tubewells, extent of infrastructure, and public sector initiative in promoting groundwater exploitation.

World Bank (1984) mentioned that more than 30% of tubewell owners in Pakistan, reported selling water, but that fraction of water sold was very small. A study by WAPDA (1990) in canal command areas of Punjab, Sindh, and NWFP found water sales in 43 out of 100 watercourses. NESPAK (1991) reported that 21% of well owners sold water, also a sample survey by Meinzen-Dick, 1996 of Sindh, Punjab, and NWFP in Pakistan recorded 66% of farmers trading tubewell water, although none was reported in the case of Sindh.

Smith and Pathan (1995) mentioned that Sindh has a 'high potential', but 'low utilization' profile for water markets. There are large and easily accessible groundwater reserves, but highly underdeveloped water markets. As noted by Palmer-Jones (1997) the best groundwater resources are associated with river channels and perennial canals.

To sum up, the review presented above demonstrates a mixed impact of groundwater markets in improving the performance of integrated management of surface and groundwater resources. While there is evidence of increase in cropping intensities, crop production and incomes in some areas, topographical, social, environmental and economic differences by regions (where water markets are in operation) are critical to the successful promotion of groundwater markets. Besides, over past few years canal shortages due to draught has also forced farmers at large scale to explore other options for irrigation purposes. In this regard, tubewell development in Sindh has gained substantial movement, it has also opened-up

the possibilities of water trading at least with neighbouring farmers on the same watercourses.

Study Area

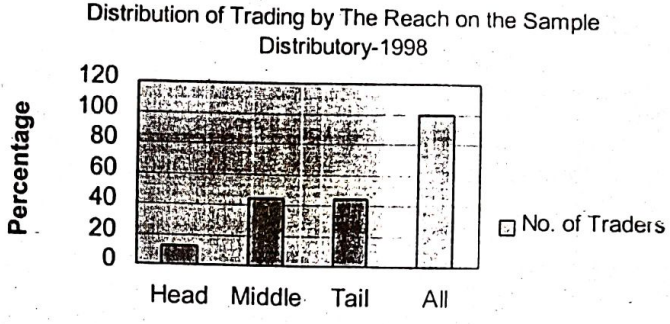
The research was conducted in the *Sakrand* unit, a project unit area for the SCARP North Rohri Transition Pilot Project. The project is located in the lower part of the Indus Plain where the problems of waterlogging and salinity are compounded by the rise in watertable and lack of some natural surface drainage. The SCARP transition project is situated along the left bank of the river Indus. This research study was based on a single visit to sample farmers to record data on performance indicators.

Study Results

The survey data showed that out of all 239 sample farmers, only 25 farmers (10%) were involved in water trading throughout the distributory. The trading in canal irrigation supplies was not popular among the farmers on the distributory, and only one farmer, who owned 12 acres and could not cultivate his land during Kharif season, sold his entire canal share to the neighbouring farmer for a fixed rate of Rs.2000 per season. It was found that water trading (both canal and tubewell water) was not common at the head of the distributory. The reason reported was that each farmer at the head had sufficient canal supplies during the year. However, during the *'Bundi times'* [2] they sold some tubewell water to neighbouring farmers on hourly basis. The majority of trading took place at the middle-tail

[2] The times when the entire irrigation system is closed for annual de-silting and rehabilitation during the months of January and February.

reach (88% of total trading) of the sample distributory.



The distribution of sample farmers who traded water to neighbouring farmers by the reach on the sample distributory shows that out of 25 traders, 12% were located at to head and 44% each at the middle and tail reaches of the sample distributory (Figure 1).

Trading Rates

Some farmers charged the cost of supplying tubewell water on an hourly basis, others sold it on a per season basis. Overall substantial variation in the trading arrangements was observed. Survey data reveals that 52% of farmers charged water on an hourly basis. About 36% of farmers sold water on a seasonal basis. Similarly, 8% of traders reported that they charged one third of crop output as a rent for selling tubewell water.

The survey data shows some variation in mean

values in the number of hours both in Kharif 1995 and Rabi 1995-96 seasons (Table 2). However, the rate charged on an hourly basis by the traders was the same for both seasons. The farmers narrated that the majority of cases were selling water to their relatives. They did not sell water on commercial basis. Therefore, the rate they charged was only to recover the operational cost of supplying water.

TABLE-2
DETAILS OF WATER TRADING ARRANGEMENTS BY SEASON ON JAMAL SHAH

Trading Arrangements	Cases %	Rabi 1995-96			Kharif 1995		
		Rate/ Hour Rs.	Hours No.	Amount Rs.	Rate/ Hour Rs.	Hours No.	Amount Rs.
Hourly	52	43	38	1665	44	45	2000
Seasonal	36	-	-	1622	-	-	1778
Canal Share	4	-	-	2000	-	-	2000
Share of Output	8	-	-	-	-	-	-

Source: Survey Data, 1998.

Table-2 indicates that the average total rate charged by the farmers on hourly basis varied from Rs.1665 in Kharif 1995 to Rs.2000 in the Rabi 1995-96 season.

During the survey, the farmers who purchased water were asked how they used the purchased water in both Kharif and Rabi seasons. About 20% reported that the purchased water was used to expand the existing cultivation area (Figure II). Whereas, 80% of farmers utilised the purchased water to accommodate canal shortages both in Kharif and Rabi seasons. They reported that although they required a continuous supply

of tubewell water throughout the year, this was not possible since the majority of tubewells were small capacity tubewells.

Therefore, these tubewells can only accommodate water needs of tubewell owner. However, largely in *'Bundi times'* or some times in the months of February and March, when canal water was inadequate to meet the crop demands, they purchased some tubewell water. They reported that during the months of May, June, and July unless it rained, water was short throughout the distributory, therefore, they had to seek for tubewell water, which was only available to take care of 20 to 30% of crop needs. As the owners themselves were using pumps to accommodate canal shortages, therefore, it was difficult to purchase water during this period.

Utilization of Traded Water on the Sample Distributory-1998

Causes of Slow Water Trading

The limited number of farmers involved in water trading in the research area can be related with several factors such as the limited availability of reliable electric supply for tubewell operations. It is argued that availability of reliable and adequate surface supplies is one of the key contributing factors in raising tubewell owner's willingness to sell some of the pumped water to neighbouring farmer(s). In a situation, where surface

supplies are scarce, and the availability of groundwater is already limited, not every tubewell owner would intend to trade water.

Traditional Practices of Irrigation Use

The SCARP project in the area was a major investment by the public sector, and the tubewells under these projects were located at the head reaches of watercourses, these were operated alongwith the canal supplies for the watercourse under the *warabandi* system. This practice was continued until the SCARP project(s) stopped functioning. Farmers reported that SCARP tubewells were sufficiently pumping groundwater for irrigation purposes (until they became un-operational) and significantly improved supplies to tail reaches. Therefore, farmers rarely traded water except in extreme situations.[3] All canal supplies, including subsequent rises in supply as a result of SCARP pumping, were controlled by the public sector IPD. The Canal and Drainage Act stated that it was illegal to sell or sub-let the whole or any portion of one's authorized right to canal water under the *Warabandi* without the permission of IPD. Therefore, these legal prohibitions restricted the irrigators from trading irrigation turns. Limited trading, however, took place among neighbouring farmers to overcome the occasional shortages of canal supplies without considering the concepts of making profit from such trading.

With transition from public to private groundwater development the pattern of tubewell development in the area has changed as tubewell installation is not regulated by the government. The concept of water trading is relatively new, and farmers

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[3] Such as exchanging irrigation turns.

have not yet realized the likely commercial benefits of trading groundwater. As a result, only a nominal scale of groundwater trading has taken place, chiefly among relatives and similar castes. These arrangements of trading water largely only recover part of the operational costs since traditionally it is not respectable to make profits or commercially trade in water for financial gains. In other words, this method of trading groundwater is to some extent assisting to accommodate the inadequacies of canal supplies.

It is mentioned that similar arrangements have been acknowledged by Kolavalli 1989, who explained that transactions are not impersonal, but are part of 'social linkages' among farmers. Therefore, in these arrangements buyers may give preference to relatives or those with whom they have other relationships, either through lower water rates or priority for services. This can be a way of dealing with high transaction costs for water sellers, particularly where water is provided on credit. The deals with clients are made within the existing transaction moralities in which trust does not equal faith in altruism but is guaranteed by the multiplexties, often multi-periodic ties, which bind the client to the service provider.

Similarly, Merry 1986 explained that "the social relationship between buyer and seller also restricts the sale and purchase of groundwater as tubewell owners are only willing to sell to close relatives or those with whom they have other ties. A major reason for sales among kin is that relatives often have the closest landholdings, due to inheritance patterns. Selling water to relatives also provides a means of controlling transaction costs and ensuring fee repayment. However, transaction costs can also be higher with relatives, either because of quarrels or difficulty in collecting payments.

Watercourse Lining

It is argued that the tubewell irrigation supply is not a commodity that can be transported far from the source to the area of application. Conveyance losses between the tubewell and the field restrict purchasers to buying from tubewells located in close proximity of their fields.[4] The distance over which it is feasible and economically viable to transmit water depends on the soils, topography and the type of channel used to convey water. Lined watercourses ensure that water purchasers receive more of water they pay for from the tubewell and permit sales to a wider potential number of fields from each tubewell. Lined conveyance structures thus go hand in hand with the development of more competitive groundwater markets.

They allow purchasers to obtain water within a wider radius of their fields, thereby increasing the number of potential suppliers. Shah and Raju 1988, reported that as competitive groundwater markets developed in Gujrat State, India, tubewell water sellers who wanted to maintain clients installed lined conveyances to ensure that water could reach as many buyers as possible with minimum losses. These advantages can not be gained in the case of the research area as out of a total of 36 study watercourses on the sample distributory, only 17% were partially lined. Lining is usually for 33% of total length, starting at the head reach of the watercourse.

CONCLUSION

This research paper viewed some of the

[4] It restricts sellers to those within a limited radius of the well.

qualitative review about groundwater markets as an important factor towards improving accessibility by resource poor towards irrigation supplies. Literature review demonstrated that the water markets operate in all provinces of Pakistan, but are most active in Punjab. The paper suggests that Sindh have a 'high potential' but 'low utilization' profile for water markets. There are large and easily accessible groundwater reserves, but highly underdeveloped water markets. It was also identified that factors such as, the scale of electricity supply needed to run tubewells, extent of infrastructure, and public sector initiative in promoting groundwater exploitation were the major concerns towards promoting groundwater markets in Sindh.

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